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Contents

PAGE

NOTICES.—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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Chemistry and Soil Fertility

AMONG the many services rendered by chemistry to mankind that of making two or more blades of grass grow where only one grew formerly is not the least notable. Within the past quarter of a century an immense advance has been made in the application of chemistry to the oldest and greatest of all industries—agriculture. The composition of soils, the alternate exhaustion and replacement of fertility, the determination of right conditions for all sorts of crops, the discovery of the part bacteria, good and bad, play; in short, the production of crops of maximum bulk and quality at the lowest cost—all this has been engaging the attention of chemists for many years now with most excellent results. And as chemical research has advanced chemical industry, as always happens, has developed with it. The artificial fertiliser industry has now attained very large proportions, and must still extend as the services of which it is capable are better understood. In this number we publish several contributions on this industry mainly in its chemical aspects. These show that, in spite of the progress made, much remains to be done in the prosecution of research and practical experiment, and in the education of the agricultural community as to the nature and proper functions of artificial fertilisers.

Sulphur as a Productive Factor

ONE ASPECT of the problem of soil treatment which has attracted quite an unusual amount of interest during the last year or so is the relation which sulphur bears to productiveness, and it has been suggested that sulphur deficiency may be responsible for indifferent results which have hitherto been ascribed to other causes. It has even been stated that in some soils sulphur may be a limiting factor, and that crop increases which have followed the application of superphosphates or sulphate of ammonia are probably due to the sulphur content (rather than the phosphoric acid or nitrogen) of these fertilisers. It is interesting to recall that sulphur has been used as a soil amendment in the United States for a number of years, and only a few weeks back we recollect seeing in one of our American contemporaries an authoritative expression of opinion on the whole question, which came from Mr. C. C. Fletcher, of the U.S. Bureau of Soils. A survey of the experimental work on crops would indicate a wide diversity of results, for whereas some plants derived considerable benefit, others gave most inconsistent returns. Mr. Fletcher remarked that as sulphur has a tendency to render the soil more acid it might have to be used in conjunction with lime where acidity is an adverse factor. This very quality, however, renders it beneficial in alkaline soil, and it has been recommended for the treatment of black alkali with the object of changing the highly deleterious sodium carbonate to less harmful compounds. As in the case of most of the soil amendments and fertilisers, it is difficult even to indicate the proper amount to apply. The soil type, crop, climate, previous cropping history of the soil, and other factors, have to be considered. In some instances experiments indicate a loss rather than a gain in the crop yield. Taking the conditions in Oregon, where sulphur has been recognised for some time as a valuable soil amendment, an application of 40 lb. per acre has been found satisfactory.

As regards the form in which the sulphur should be applied, it is pointed out that the elemental material is relatively cheap, while as it is in concentrated form it will stand transport costs more readily than some of the other forms of sulphur. To give the best results it would appear to be necessary to "inoculate" the sulphur with the somewhat peculiar organism (*Thiobacillus thio-oxidans*) which operates as a most effective oxidiser of the elemental sulphur. American workers have demonstrated that by treating soils with sulphur inoculated in this way acidity is undoubtedly increased, and thereby the crop is rendered more immune from attack by disease and pests. The whole

matter is, however, as yet in an experimental stage, and the time has by no means arrived for the general application of sulphur in lieu of more familiar fertilisers.

Gas Companies and Chemicals

THE DECISION in the action brought by the Secretary of the Castner-Kellner Company against the Gas Light and Coke Company to restrain the company from the manufacture of caustic soda establishes no new principle, but it confirms a theory of their rights and limitations which gas undertakings have commonly held and acted upon. That theory is that while restricted from the manufacture of chemicals for competition with legitimate chemical manufacturers, they may themselves manufacture such chemicals or other substances as are necessary to the prosecution of their own proper business. In other words they must not make chemicals for public sale and distribution, but they may make the chemicals required for use in their own works. The general business of gas concerns is to undertake the carbonisation of coal and to deal with the various by-products therefrom, and it would be an extreme condition if they were compelled to purchase from outsiders everything required to carry on their business. They may, of course, purchase them if they prefer to do so; equally, if they prefer and are able to do so, they may provide for their own requirements from their own resources. In the early days when gas was the main product and such by-products as tar were treated as of little value, the companies depended largely on external supplies, but the chemical and engineering aspects of coal carbonisation by gas undertakings have latterly undergone enormous expansion, and the development of their chemical and engineering organisation and plant has had to keep pace. If a company is free to employ a chemical staff for its own purposes, it would seem but logical that it should be free to produce its own chemicals—and the same applies to plant, and every other part of the organisation.

All this, however, is subject to one clear condition—that any chemicals manufactured by a gas undertaking for its own domestic needs must be strictly limited to those needs. The position is much the same as that of a great chemical concern which may be allowed to manufacture gas or electricity strictly for its own use, but must not produce it for sale in competition with statutory gas or electricity companies. While as a general principle the present case reaffirms the right of gas companies to manufacture chemicals to be used strictly and solely in their own works, and seems sound to that extent, the enormous development of chemical operations in gasworks makes it important for chemical manufacturers to watch against any unfair extension of the present right and the setting up of any precedents which might prepare the way for unfair competitive trading with chemical manufacturers. The present action, therefore, though unsuccessful, may not have been so purposeless as might at first appear. To adopt a popular term, it may have served a useful purpose as a "gesture"—a note of warning to gas concerns that chemical manufacturers are on the watch and are determined to stop any sort of poaching on the legitimate industry of chemical manufacture.

When Labour Rules

WE have actually been under Labour rule for three or four days, and the country has not even begun its pilgrimage to the dogs. The advent of Mr. Ramsay MacDonald has merely coincided with two events of some public interest—a railway strike which Labour seems no more able to control than Conservatism or Liberalism, and the death of Lenin, for which the new Administration can hardly be considered responsible. The Labour Ministry, like others, has its proportion of peers and eminent lawyers, distinguished writers and sociologists, several reputedly wealthy Labour leaders, and two or three people who have actually worked. From the handsome photographs and biographies which adorn the dailies one may judge our new rulers to be not very different from the rest of their countrymen; they merely look a little more self-conscious, and are obviously trying very hard to appear at home with their new jobs. A reassuring sign is the increased correctness with which they dress—the *Tailor and Cutter* will presently, no doubt, set us right on the technique of the business—and last, and most distinctively British of all, the new Ministers' wives and daughters are already preparing their *salons* for entertaining high society. The revolution, in fact, is proving far less exciting than we had a right to expect. After the fireworks in which the Baldwin Ministry disappeared, our first Labour Government threatens us for the present with nothing worse than a higher degree of respectability than any of recent times. In fact, without such cheerful souls as Mr. Jack Jones, our new rulers might prove rather dull company.

Corrosion by Mine Water

CORROSION as a problem seems mainly to have been studied in so far as it is occasioned by the atmosphere and other gases. It is seldom, in fact, that one sees any reference to the heavy wear and tear which results, particularly in mining equipment, from the effects of acid mine water. The problem is one, of course, which is mainly confined to a particular industry, and although it cannot be compared in extent with that of atmospheric corrosion there can be no doubt that very considerable financial losses are continually falling on mine operators through the failure of pumps, pipelines, and other equipment due to the action of the acid mine water. This water usually contains considerable quantities of sulphates of iron and aluminium, and smaller amounts of sulphates of calcium, magnesium, sodium, and potassium, while silica and chlorides are frequently present. The actual chemical composition of the solution may, however, vary almost from minute to minute, and apart from the influence of this factor it has been shown that the velocity of the water (or the rate of movement of the material in it) is undoubtedly important in affecting the corrosion rate. The whole matter is one which should be of no little concern to mining engineers in this country, for corrosion of the kind must have an appreciable effect on the expenditure on upkeep and renewals.

We are not sure whether any stereotyped methods for reducing the effect are employed over here; but recently we came across some suggestive remarks which fell from Mr. George M. Enos in the course of a

Paper he read before the Engineers' Society of Western Pennsylvania. Mr. Enos pointed out that suggestions had been made that, if the water was neutralised underground, the pumping equipment would not be corroded, the neutralising agents sometimes used being lime-rock and blast furnace slag. There are, however, many objections to such a method as it involves considerable expense in the way of plant and labour. The American investigations were responsible for many helpful suggestions, and it was pointed out that there are certain corrosion-resisting alloys; namely, a high-silicon cast-iron, a high-chromium steel, high-chromium-nickel-silicon steels, and a nickel-chromium-iron alloy, which may well be substituted in pumping equipment in place of the more readily corroded materials. So far as the serious problem of the corrosion of pipes is concerned, it is pointed out that by lining the pipes with wood it is possible to obtain a satisfactory period of service, and this treatment seems to provide the best remedy.

The Importance of Colloids

THE chemistry of colloids is becoming a matter of increasing importance in its industrial applications, yet to many practical men the subject is rendered unduly difficult by the number of technical terms and mathematical expressions so frequently used by the exponents of the subject. Chemistry is such a highly developed technical subject that a specialist in one line sometimes forgets that specialists in other directions may not necessarily be able to understand his particular jargon. These technicalities on the part of the theorist sometimes prevent the industrial technician from investigating theoretical developments which would perhaps be of considerable commercial value to him. In the case of the study of colloids there are special technicalities of this kind, yet the results of recent work in this field have important bearings on such industrial processes as absorption, filtration, and the use of catalysts. The exposition of these matters by Dr. E. K. Rideal in the first of the three Cantor Lectures on Monday was of the type which is sufficiently precise, and yet sufficiently simple to be of real value to those who are most likely to benefit by a knowledge of the latest theories of this branch of chemistry.

Import of Dyestuffs

FROM communications which have reached us we gather that some perturbation has been caused by our reference last week to the advisability of restricting licences to "*bona fide* British importing houses." This has been taken to mean that only accredited "agents" of German or other foreign firms should be granted licences, and that independent importers of colour should be excluded. If any competitive conflict exists between these two interests, it seems to us to be purely a domestic matter between themselves, and we have no intention of intervening in it. From the public point of view the points that matter are that the imported colours should be what they are represented to be and that the price at which they are offered for sale should be the fair trade prices.

Points from Our News Pages

Special articles are published dealing with Some Recent Problems with Phosphatic Fertilisers (p. 84), The Effects and Uses of Potash Fertilisers (p. 87), and The Use of Lime in Agriculture and Horticulture (p. 88).

Dr. E. K. Rideal delivered on Monday the first of a series of three Cantor Lectures at the Royal Society of Arts, dealing with "Colloid Chemistry" (p. 91).

The hearing of the claim by Dr. Levinstein and Professor A. G. Green in respect to the production of Mustard Gas was continued in the Law Courts on Monday (p. 92).

Judgment was given for the defendants in the case brought by the Secretary of the Castner-Kellner Co. against the Gas Light and Coke Co. to restrain them from making certain chemicals (p. 93).

Business in the London Chemical Market has been severely affected by the railway strike, which has caused a decided set-back (p. 102).

There was considerable improvement in the Scottish Chemical Market immediately before the railway strike (p. 105).

The Calendar

Jan.		
26	West Yorkshire Metallurgical Society: "Use of Scrap Metals." G. Lodgard. 3 p.m.	Technical College, Bradford.
28	Royal Society of Arts: Cantor Lecture II, "Colloid Chemistry." Dr. E. K. Rideal. 8 p.m.	John Street, Adelphi, London.
29	Society of Dyers and Colourists (Leeds Junior Branch): "Works Filtration." Dr. Forster.	Leeds.
29	The Society of Dyers and Colourists (London Section): "The Effect of the Action of Micro-organisms on Fibres and Fabrics." A. C. Thaysen. 7 pm.	The Dyers' Hall, Dowgate Hill, London, E.C.3.
30	Royal Society of Arts: "The History, Development and Commercial Uses of Fused Silica," Sir R. A. Surtees Paget. 8 p.m.	John Street, Adelphi, London.
30	Sir John Cass Technical Institute: Distribution of Prizes and an address on "Research Work and its Applications." Sir William Bragg. 8 p.m.	London.
31	Society of Chemical Industry (Birmingham Section): "Some Special Problems in Volumetric Analysis." T. Tizard. 7.15 p.m.	The University, Birmingham.
31	Society of Dyers and Colourists (Bradford Junior Branch): "Acid Dyes." H. Marsden.	Bradford.
31	Royal Society: Papers by A. Mallock, A. K. Goard, E. K. Rideal, and others. 4.30 p.m.	Burlington House, Piccadilly, W.1.
Feb.		
1	Public Lecture: "Food and Why We Require it." Dr. J. A. Hewitt. 5.30 p.m.	University of London, King's College, Strand.
1	Royal Institution of Great Britain. "Recent Research on Crystalline Structure." Sir W. Bragg. 9 p.m.	21, Albemarle Street, London, W.1.
1	Society of Chemical Industry (Manchester Section): "Reminiscences of Dr. Caro." Dr. Ernest F. Ehrhardt. "The Dehydration of Alcohol by means of Glycerine." Professor E. Knecht and E. F. Muller. 7 p.m.	Textile Institute, 16 St. Mary's Parsonage, Manchester.

Phosphatic Fertilisers: Some Recent Problems Discussed

In this article the author discusses some of the theories which have been put forward to explain the phenomena of the absorption of phosphates by plants, and the influence of other chemicals present in, or added to, the soil.

THE science of plant nutrition has advanced steadily during the past few years, and if its progress has not been particularly brilliant or marked by any epoch-making discoveries we have nevertheless travelled far from the time of Liebig's first theory of fertiliser action. This theory postulated that it was merely necessary to return to the soil the exact equivalent of those substances—nitrogenous, potassic, phosphatic—taken therefrom by the plant and determined by rigid chemical analysis. This was a theory beautiful in its simplicity, but is now seen to be quite inadequate to meet the almost baffling complexity of soil problems and plant nutrition. The complexity increases with increasing knowledge, and the action of phosphates in the soil and their absorption by the plant are not among the least complex of the problems to be dealt with.

From the time of Lord Dundonald, who published his treatise on "The Connection of Agriculture with Chemistry" in 1795, the supreme importance of phosphates has been recognised. That early and distinguished writer on scientific agriculture described the various sources of calcium phosphate and observed that a very considerable proportion of this nearly insoluble salt is contained in most fertile soils, that the alkaline phosphates promoted vegetation to a very marked degree, and that the substances of which they are composed, viz., alkaline salts and phosphoric acid, are found in the ashes of most vegetables. The eminent agricultural chemist, F. Czapek, has more recently, by means of water cultures, demonstrated the avidity and quickness with which phosphoric acid is absorbed by the plant. If mono-calcium phosphate, KH_2PO_4, be added to a water culture, of which the acidity has been previously determined, and the acidity is then again determined 24 hours thereafter, it will be found that there is a considerable reduction in acidity, since the H_2PO_4 ions, dissociated into H and HPO_4, are more rapidly absorbed. Phosphoric acid is found in plants not only in the form of inorganic phosphates, but also in the form of important organic compounds, such as proteids, globoids, lecithin, etc., thus further illustrating its extreme importance in plant economy. For the most part phosphoric acid is absorbed by the plant as inorganic phosphate (di- tri- or tetra-) of calcium or magnesium, dissolved in the soil water and also present in decaying roots and stubble. It has indeed been held by B. J. Stoklasa, from some experiments with oats, that plants can directly obtain their phosphoric acid from organic phosphates, such as lecithin and glycero-phosphate, but F. Czapek and others point out that such direct absorption is very improbable, since the organic phosphates are readily broken down in the soil under the action of bacteria into inorganic phosphate; although it is quite possible that the plant may directly take in any salt of ortho-phosphoric acid and also, indirectly, the lower phosphoric acids (meta- and pyro-).

Comparative Availability of Phosphoric Acid

The "availability" of phosphoric acid to a plant depends on a great variety of different factors, including the chemical and mechanical nature of the soil, the previous crops grown and fertilisers used for them, and the crop now being grown. For example, in moist districts and on sour soils ground mineral phosphate, for meadow grass or turnips, is very often equal to highly soluble basic slag, and in some cases, on sweeter and drier soils, it is not much inferior to slag despite its low citric solubility (G. S. Robertson, Monograph on "Basic Slag and Rock Phosphates," J.S.C.I., 1922, 320r). Some interesting experiments on the respective availability of phosphates of aluminium, iron and calcium have been undertaken by J. S. Marais (Soil Science, 1922, 13, 355). It is concluded that all three normal phosphates are equally available, but that the basic hydrated (mineral) phosphates of iron and aluminium are less so. This could be remedied by ignition. Lime increased the availability of the aluminium phosphate, had no effect on the ferric compound, and reduced that of calcium phosphate—as one would naturally expect. Mineral phosphates are more available to some crops than to others, a fact which has long been known, but its true significance and explanation are still to seek.

One of the most interesting of recent papers on phosphates is that of a German woman chemist, M. von Wrangell, who has carried out numerous pot experiments with different plants, from which she concludes that the power of any species of plant to utilise relatively insoluble mineral phosphates varies directly with the ratio of CaO : P_2O_5 in its ash. Of the fourteen species examined the lowest phosphorus utilisation was shown by wheat and rye, and the highest by buckwheat. The low reaction of wheat to phosphatic fertiliser compared with the relatively high importance of phosphate to barley, although these two grain crops are very similar in composition, has long been known, and is well described in Hall's *Fertilisers and Manures*, together with the Rothamsted experiments bearing thereon. It shows more clearly than anything else the inadequacy of mere chemical analysis as a true guide in plant nutrition—as is also the case in animal nutrition. It may be parenthetically surmised that there is a profound analogy between the vitamins of animal nutrition and the hormones of plant nutrition, both of which have hitherto eluded analysis; but this interesting aspect of the question cannot be further studied here.

In somewhat close relation with M. von Wrangell's experiments are those of K. Mack, who found that insoluble phosphates are rendered soluble by colloidal humic acid, and that ammonium humate acts on phosphates of iron and aluminium to give soluble substances which appear to contain humic acid, phosphoric acid and metal in a complex anion.

M. von Wrangell's results and the theory she has deduced therefrom have aroused considerable interest in Germany, where increasing attention is now being given to phosphatic fertilisers. Most of the orthodox school of agricultural chemists in Germany are very strongly against the new theory, and it has been closely examined and vigorously attacked in a pamphlet recently published, and to which such eminent authorities as Lemmermann, Mitscherlich, Nolte, Hasenbäumer and others have contributed.

Absorption of the Mineral

The exact manner in which mineral nutriment is taken in by the plant is even to-day not clearly known. It is taken for granted that the plant food must be in soluble form and passes into the plant chiefly through osmotic action. But solubility here is a vague unsatisfactory term, for it does not necessarily mean mere solubility in the soil water, but something more than this. Solid particles of soil are often found attached to the roots, and the specific action of the root hair juices is not precisely understood. These root hairs and their juices must have powerful solvent and breaking down properties varying with the nature of the plant, the nature of the original soil, the season of the year, the weather, the soil temperature, the fertiliser added, the bacteria in the soil, the nature of the previous crops, and whether one or more fertilisers are used. The complexity of the problems may be well apprehended from a consideration of these very diverse and numerous factors.

In a paper published in 1920 M. von Wrangell gave reasons for supposing that, in the case of phosphoric acid, there is a kind of alternating or reciprocal absorption of kation and anion. This is taken to mean a change in the soil reactions in some mysterious way whereby insoluble or nearly insoluble substances are more readily absorbed. It is well-known that certain plants are capable of taking up nearly insoluble phosphate under certain conditions. Some investigators, *e.g.*, Aberson, Mitscherlich, and notably F. Czapek, argue that in the cell contents of the root hairs there is an acid solution which may enter into free di-osmotic exchange with the soil salts. Since different cultivated plants are able to take up varying amounts of difficultly soluble mineral matter E. Mitscherlich concludes that this varying characteristic of individual plants is not chemical or due to any particular root exchanges, but is rather to be attributed to physical variations. But according to Czapek there are only small quantities of acid calcium phosphate present in the root hairs, and this may of course exert a solvent action either directly or by reacting with chlorides. He advances the very interesting

hypothesis that the carbon dioxide produced by root respiration has a very decided solvent action on the hardly soluble mineral matter in the soil, and that the action of this carbon dioxide solution is fully equal to that of any other acids of equivalent hydrogen ion concentration. Accordingly, the sorption of insoluble or nearly insoluble soil constituents is doubtless due to a very active solvent action of the roots, not by virtue of a special acid root secretion but entirely owing to the carbon dioxide respired by the roots. The same author in 1915 had already arrived at the conclusion that the solvent power of the roots was closely associated with colloidal conditions, in agreement with Baumann and Gully. Other writers, *e.g.*, Aberson, have also held that there is a saturated carbon dioxide solution in the mucilaginous membrane of the root hairs sufficiently acid to bring into solution the insoluble soil constituents, especially phosphates; although H. Kappen does not go quite so far as this, and is of opinion that it is highly improbable that the membranous secretion of the root hairs, in so close contact with the soil particles, can form a saturated carbon dioxide solution, since such a solution is exposed to the action not only of the external soil water but also, by diffusion, to that of the root juices of the plant. Kappen, after numerous electrometrical estimations of the acidity of various root juices, concluded that acidity determined by titration was not an absorption effect, but was due to the actual presence of acid—in agreement with the results of Lemmermann and others.

Solvent Action of Carbon Dioxide

It is well-known that plants differ greatly in the acidity of their root juices: some, like the Graminaceae (grasses), have a very low acidity, whilst others, *e.g.*, leguminous plants, have a much higher acidity, although this does not apply to all the legumes. There is no doubt then that in addition to the vital processes in the plant enabling it to take up apparently insoluble soil constituents there are also unmistakably organic acids present or secreted in the root which have a powerful solvent action. On the other hand, the well-known experiments of Sachs and also of Czapek, with slabs of gypsum, etc., seem to show that the solvent action is almost entirely due to carbon dioxide in solution, and the further experiments of Kossowitsch seem to favour this view.

Adverting again to M. von Wrangell's work and the importance of the lime : phosphate ratio, she concluded from her experiments that if this factor is high there is a good absorption of calcium phosphate, but if the factor is low the absorption is bad. Both the theory itself and its explanation are a little difficult to follow, but it is supposed that the root juices or secretions, together with the carbon dioxide solution in the root hair membrane, both act on the calcium phosphate present in the soil and in immediate contact with the root hairs. The "lime-loving" plants will at once utilise the dissolved calcium ions and dissociation of the calcium phosphate proceeds; but with plants having a low "lime tolerance" there is a gradual concentration of calcium ions in solution as compared with the PO_4 ions, so that further solution and dissociation of the calcium phosphate temporarily ceases. Those plants therefore which begin entirely or almost entirely with the absorption of kations will induce an acid soil reaction enabling them again to take up phosphoric acid. It follows that all plants which are able to use a comparatively large quantity of lime can also utilise a corresponding amount of phosphoric acid. But the smaller the lime intake and the lower the power of the plant to render harmless an excess of lime so much the more will its capacity for absorbing phosphoric acid from calcium phosphate be reduced. For example, leguminous plants with a high lime tolerance can, as a rule, the more readily utilise the phosphoric acid present in the soil; but other plants, such as grasses, with a low lime capacity, are much less able to do so. The lupins are of particular interest in this connection, for, although distinguished by a high acidity yet they frequently seem not to thrive in the presence of easily soluble or alkaline lime salts. According to H. Kappen it is possible that the acid root juices of the lupin, when the plant is grown in a richly limed soil, are largely neutralised, and this reduced acidity inhibits the power of the roots to take up sufficient nutriment in the form of phosphoric acid and iron.

The Effects of Mixing Fertilisers

It has long been known that plants differ greatly in their ability to absorb difficultly soluble soil phosphates, and it seems that all M. von Wrangell may claim as new is her hypothesis of a kind of genetic relation or ratio between the lime and phosphoric acid intake. But this theory does not seem to take account of all the factors in the complex relations between soil and plant and added fertiliser and the action of one fertiliser on another when given together. The effects of added fertilisers on the solubility of soil phosphates has been studied by numerous workers, among the first being the Russian chemist, Prianischnikov, who has just recently completed some important research in connection with the utilisation of the vast phosphatic deposits in Russia. In particular, he noted some years ago that the lime content of the soil is of special significance, and that in general the absorption, *e.g.*, of phosphoric acid, by one and the same plant, is markedly influenced by the presence in the soil of definite bases and acids. Some good work in this direction by Prianischnikov's colleague, Kossowitch, has been already referred to. According to her German critics, M. von Wrangell has merely repeated the work of previous investigators and confirmed the results, although F. Aereboe, in a book published in Berlin last year, regards her experiments as entirely new and even epoch-making, and appears to suggest that the importance of work of this kind, namely, the interaction of different fertilisers, is not sufficiently realised. Against this, however, it is urged that so long ago as 1904 Söderbaum pointed out what a valuable field for research was to be found in the study of the reciprocal action of different fertilisers when two or more are used together. The most severe criticism against von Wrangell has been that of P. Ehrenberg who charges her with giving little or no credit to the Russian chemists, although their work was evidently known to her; and as for Aereboe's assertion that a way has been found for utilising the insoluble phosphates already present in most German soils, sufficient to last perhaps 100 years or more, without importing foreign phosphate, this is ridiculed as being quite inapplicable to most German soils. The subject has indeed formed material for severe and typical German polemic.

The Influence of the Soil

Among the factors to be noted in connection with availability of phosphate, as Dietrich has shown, are rainfall and other atmospheric influences. With certain light soils consisting largely of weathered sandstone, practically the whole of the phosphate may be removed by rainfall, and this is said to be the explanation why some light soils of this kind are not benefited by addition of phosphate. Then there is the important question of the action of carbon dioxide, dissolved in rain-water or otherwise introduced into the soil. According to the famous slab experiments of Czapek, material readily soluble in CO_2 solution, *e.g.*, carbonates or phosphates of calcium, magnesium and iron, was easily corroded by plant roots, whereas slabs of material such as aluminium phosphate not soluble in a saturated solution of CO_2 but readily soluble in mineral and organic acids, was not attacked by the roots. The true significance of Czapek's experiments is well brought out in Hall's *Fertilisers and Manures*. Von Wrangell does not seem to have added much to our elucidation of the carbon dioxide mystery. In the case of a carbonaceous apatite from East Prussia she attributed its easy solubility by the plant and by dilute organic acids to the carbon dioxide present in this material. It is, indeed, well known that such a material as weathered phosphorite, for example, containing carbon dioxide, is readily taken up by plants under certain conditions, but this is not the case with a variety of apatite free of carbonate.

It is clear then that the availability of the soil phosphate to the plant must vary greatly according to the rocky constituents of the soil. In most soils there will be not only the original soil phosphate, mostly insoluble, but also added phosphate originally soluble but becoming in course of time quite insoluble. If not otherwise available, the roots of the plant must seek deeply for their necessary supplies, and this means an expenditure of energy which the plant would otherwise put into growth above ground.

No Molecular Lime-Phosphate Ratio

The ability of certain plants like the leguminous class to utilise nearly insoluble soil phosphates is attributed by von Wrangell to a marked assimilative capacity for lime. This is strongly disputed by her critics, who maintain that such a conclusion is not justified by her own experiments, and further, that there is no molecular ratio of CaO to P_2O_5 in plants. But

this does not seem to be any great argument against the theory which merely postulates a certain relation or ratio *at the time when the substances are taken in by the plant*. Ratios may and do radically change afterwards. The same observation applies to the other objection that plants in dry years contain less phosphoric acid and more lime. The Dutch worker, J. G. Marchhaupt, concluded from his experiments that the lime content of plants varies little, whilst the phosphoric acid content varies greatly. Other critics insist that the hypothesis rests on very slender grounds of insufficient experimental evidence, being based on only a comparatively few pot cultures, without any confirmation from open field trials. F. Aereboe's statement, that the greater the lime requirements of cultivated plants the greater the possibility of their utilising the difficultly soluble calcium phosphate of the soil, is not true even in the case of lupins, whose capabilities in this direction are due to a high root acidity and not to a high lime tolerance. It is concluded generally that the new theory is not sufficiently supported, and remains for the present merely a slightly plausible hypothesis.

Aereboe seems to have gone much further than M. von Wrangell and has rushed to the conclusion than an entirely new system of fertiliser practice is now possible of the utmost benefit to Germany. He accordingly comes in for the most severe treatment, especially as he appears to be something of an outsider in the eyes of the orthodox German agricultural scientists.

A Complex Problem

This branch of fertiliser science is admittedly complex. O. Lemmermann has, for example, observed that even though the addition of ammonium sulphate may increase the availability of soil phosphoric acid the ultimate effect is not always favourable to plant growth. And when Söderbaum, in his experiments with oats, using tricalcium phosphate, substituted ammonia for nitrate, the crop yield was much increased, whilst under precisely the same conditions the barley yield was reduced. The very diverse response of barley and oats to the same treatment is of course well known, especially from experience at Rothamsted. Similar results were obtained by Mitscherlich in 1912-1913. He used di- and tri-basic calcium phosphate, with and without addition of ammonium sulphate, and with equal and varying amounts of solvent, and found that the solubility of the phosphate was largely affected. He concluded that the increased solubility of the phosphate was solely due to ion reactions and the law of mass action. He found also that small quantities of ammonium sulphate used jointly with di- and tri-basic calcium phosphate increased the crop yield, whilst larger quantities acted unfavourably—doubtless due to acidity. But here again there are great differences in the behaviour of farm crops under acid conditions. Potatoes and rye appear to be little affected, whilst barley, and most of all leguminous plants and root crops, are extremely sensitive to soil acidity. P. Wagner and O. Nolte have shown that a generous application of nitrate, especially in the form of ammonium sulphate, when sowing leguminous plants, is bad practice; and A. Stutzer has recently observed that the injurious effects of ammonium sulphate are to be attributed to free sulphuric acid, and that there is considerable risk of unnecessarily and injuriously increasing soil acidity.

Lemmermann concludes from his open field trials that in all good soils ammonium sulphate is so quickly nitrified that it can hardly be broken down by the plant to any great extent. If, then, the two acids, nitrous (or nitric) acid and sulphuric acid are produced—and they can of course easily dissolve insoluble phosphate—these acids will very soon combine with the basic soil constituents, such as calcium carbonate, silicates, etc., and thus lose their solvent power. Where these reactions do not take place and an increase of acidity results the conditions are no longer favourable for plant growth, and no amount of nitrate or potash will make them so.

The Action of Potash Salts

There is also the action of the soil itself on the fertiliser to be considered. When potassium salts are applied it may happen that through base exchanges aluminium is set free and easily soluble phosphates may be converted into the difficultly soluble form. Although, therefore, the potassium salts may be "physiologically" acid, they may, under certain conditions, fix the phosphate still more intractably in the soil. Soils, again, may be either saturated or unsaturated in regard to their absorption of ammonium sulphate. If they are unsaturated they may break up both the nitrate and the sulphate and absorb a part of the base: and in that case before the plant has a chance of inducing a physiological change in the fertiliser action an acid soil reaction is produced. Conversely, if the reactive colloidal silicates are saturated the effect of a physiologically acid fertiliser is inhibited. A physiologically acid or alkaline reaction, due to absorption by the plant of a part of the fertiliser, can therefore only be anticipated where the soil remains neutral and without any action on the fertiliser.

These few considerations, a few among very many, show how rash any hastily drawn deductions must be, especially by those who have not carefully and thoroughly studied these things during many years of patient work under the actual conditions of the farm. Acidity is now one of the most important subjects of investigation by soil scientists in Germany, and some interesting work in this connection has been recently published by H. Kappen and Clausen. The danger of soil acidity, especially by the removal of lime, is already sufficiently great owing to weathering processes, the removal of lime by plants, and the addition of artificial fertiliser such as ammonium and potassium salts which tend to increase acidity. It seems hardly worth while to risk a further increase of acidity for the sake of a purely hypothetical increase in soil phosphate availability.

Sulfurophosphate—A New Phosphatic Fertiliser

(From a Correspondent)

"Sulfurophosphate" has been used in France during the last two years with good effects. Although this fertiliser was practically unknown in 1921, the demand for the coming season has already amounted to about 10,000 tons. "Sulfurophosphate" is a phosphatic manure which can be supplied in various strengths of phosphoric acid, ranging from 14 per cent. P_2O_5 up to 28 per cent. P_2O_5. Its fertilising qualities are similar to those of superphosphate, the principal constituent being ground phosphate.

There is, however, this difference—that whereas in order to obtain superphosphate, the raw phosphate is treated with sulphuric acid, "sulfurophosphate" is the result of a combination of sulphur and raw ground phosphate, and it is claimed for "sulfurophosphate" that this process hastens germination. This has been confirmed by experiments both in pots and in the open air. It can be used in all cases where superphosphate is usually applied, and can also be employed for all compound manures, but it has the additional advantage over superphosphate that the former may be mixed with cyanamide, whereas the latter cannot.

It is well known that sulphur has certain fertilising qualities, and that some plants, especially beetroots, absorb considerable quantities, thus promoting the formation of starch. Whereas superphosphate is water soluble, the phosphoric acid contained in "sulfurophosphate" is made soluble in the soil by the action of the sulphur, which, when coming into contact with organic matter, forms gases and releases the phosphoric acid; in this respect "sulfurophosphate" is also different from superphosphate, which, being water soluble, stands the risk of having the phosphoric acid washed away before the plants can assimilate it. "Sulfurophosphate" is a dry, grey substance finely pulverised and non-corrosive, so that it does not burn the bags in which it is packed.

Paint the Greatest Protectionist

Mr. S. K. Thornley presided at the Queen's Hotel, Birmingham, on Thursday, January 17, at the annual dinner of the Midland Varnish, Paint and Colour Manufacturers' Association. Among those present were the Lord Mayor (Alderman T. O. Williams), Mr. Gilbert Vyle (president of the Birmingham Chamber of Commerce), and Mr. Mark Harrison (president of the National Federation of Associated Varnish, Paint and Colour Manufacturers' Associations). The Lord Mayor, Mr. P. M. Sturge, Mr. Mark Harrison and Mr. Gilbert Vyle responded to the toasts, and the latter stated that Protection was the oldest law in nature, and the Varnish, Paint and Colour Manufacturers' Associations were the greatest Protectionists of all, as they stood between decay, red rust, and dissolution.

The Effects and Uses of Potash Fertilisers

The Need for More Research

By G. A. Cowie, M.A., B.Sc., F.I.C.

The author, in emphasising the pressing need of the co-ordination both of experimental schemes and of research plant, indicates many practical problems awaiting investigation from both points of view.

It is being increasingly realised that effective propaganda among farmers in the future regarding the use of fertilisers must be based more and more on the results of sound and properly co-ordinated research. This applies very particularly to potash, the effects of which are still far from being entirely understood even by scientific men. Since the essential fertilising importance of nitrogen and of the minerals, phosphates and potash has been established, mainly by Lawes and Gilbert's experiments, commenced in this country over 80 years ago, the investigation work in regard to potash has been mostly confined to the ordinary field experiment designed to ascertain the practical effect of including potash in complete dressings on different crops and soils.

For the most part these experiments have not been co-ordinated in any way, but have been carried out by independent workers who have followed their own scheme, with the result that what might have provided a basis of useful data for the establishment of important practical points has proved to be largely useless in consequence of the lack of purpose and uniformity in the experimental schemes. To a large extent these independently conducted field trials have had no greater value than that they have demonstrated the effect of a potash dressing on a particular crop in a particular field in a particular year, as practically no proper attempt has been made to correlate the results with soil, type, climatic or other conditions.

Co-ordination of Experimental Schemes

To illustrate what can be achieved by co-ordinating these experimental schemes, we were up to a year or two ago, so far as this country is concerned, without any reliable evidence about the effects of different potash fertilisers on the yield and quality of potatoes, but thanks to the recent putting into force of a uniform scheme at different official centres in Great Britain to cover various seasons and different soils, we are already in possession of valuable knowledge on the subject from the broadest point of view. These experiments have demonstrated in most cases the superiority in yielding power of the concentrated potash manures, the sulphate and muriate of potash, over the lower grade salts like kainit or 20 per cent. potash salts which contain large amounts of salt.

In amounts above a certain limit the chlorine ion appears to depress the germination and growth, while even in amounts as provided by practical dressings of 2 cwts. of muriate of potash per acre, it has the effect of reducing the dry matter in the tuber. While the difference between muriate and sulphate of potash does not appear to be reflected appreciably in the yield, potatoes grown with muriate of potash under certain conditions do not cook so well and possess a tendency to go black after cooking. The quality of potatoes grown with kainit and other low-grade salts is still more detrimentally affected. In what way the chlorine ion affects the potato is not yet known, but it has been generally observed that potatoes grown with the chloride, even with chloride of potash (97 per cent.), are slightly lighter green in the leaf and ripen off earlier than those grown with sulphate of potash.

This scheme of experiments, which has been going on for a few years and is not yet concluded, is destined to throw light upon important points connected with the use of potash under various conditions prevailing in the important potato-growing districts in Great Britain.

Co-ordinated Plans of Research

Another question awaiting elucidation by a properly co-ordinated plan of research is that concerned with the best economic dressings of potash to recommend for various crops under different conditions of soil and climate. At present our recommendations are mostly empirical quantities, such as a dressing equalling 1½ cwt. sulphate of potash per acre for potatoes with dung and 2 cwt. without dung, but there is evidence which indicates that larger dressings would be more remunerative. This would be governed largely by the size of crop possible to get, but under conditions where high yields are possible more exact evidence is likely to show that we are rather under-manuring than over-manuring. At the Midland College an experiment to ascertain the most profitable quantity of a mixture of artificials to use for potatoes along with 12 tons of dung has been carried out for three years, and the results show that dressings above the more or less conventional 6 cwt. per acre are profitable up to approximately 10 cwt. per acre, although the yield with 16 cwt. was below that with six. The mixture used was three parts superphosphate, one part sulphate of ammonia, and one part sulphate of potash, so that on this basis 2 cwt. sulphate of potash per acre would have been profitable, assuming the balance to be right. So far there has been very little experimental work of this kind done to help us to answer intelligently the question which is continually being asked by the farmer, as to how much he should use per acre.

Qualitative Effect of Potash Dressings

There is also urgent need of investigation work to determine the qualitative effects of potash dressings. This has been undertaken in regard to potatoes and barley, and the results are likely to be important. One often hears the opinion expressed by the farmer that his barley sample has been materially improved by the use of potash, but we have practically no scientific data to show what this effect is and under what conditions it is produced. The lack of sufficiently refined methods of analysis has in the past proved an obstacle to the attempt at finding a satisfactory correlation between the practical tests of the maltster and the chemical composition of the grain, but this difficulty is likely to yield itself to the results of research.

Similar research is needed to determine the influence of potash dressings on the sugar percentage in sugar beet and mangolds. What evidence exists indicates to a large extent that potash is the important factor in the production of sugar in such crops. In view of the extended growing of sugar beet in this country, the time is now ripe for initiating an elaborate scheme of research work to ascertain the best economic manuring for the production of maximum yields of sugar per acre.

Potash in Fruit Production

Little work has so far been done to determine the value of potash in fruit production, but a promising investigation has been started at Long Ashton Research Station, which is likely to throw important light on the influence of the various plant nutrients on the production and quality of fruit. This work has already indicated that leaf scorch may be caused by the deficiency of potash in the soil, and field experiments have been inaugurated with a view to seeing whether it is possible to cure this trouble by potash dressings. The work at the Cheshunt Research Station has also demonstrated the importance of potash in tomato production, not only for increasing the yield but for rendering the plants more resistant to such diseases as stripe. The development of this sort of work is greatly needed to see how far it is possible to control other fungus diseases in horticulture by potash applications. All the evidence indicates that an unsatisfactory balance of the plant food ingredients in the soil, especially high nitrogen and low potash, is a strong predisposing cause of disease, and that the latter may be prevented or reduced considerably by putting the balance right by means of liberal potash dressings. Another important discovery of the Cheshunt research work is that the uneven ripening of tomatoes or the so-called "waxy patch" or "green patch" may be caused by the deficiency of potash in the soil.

Potash Dressings for Grassland

Another sphere where careful research work is needed to ascertain the value of potash dressings is grassland, especially on the lighter types of soil. Most of the more exact sheep-feeding tests have been carried out on heavy grassland, where basic slag has proved eminently valuable as a treatment, but

the addition of potash, as well as of phosphates, appears to be a *sine qua non* in the case of grassland on most sandy and peaty soils. This has been recently brought home by the first year results of the manuring-for-milk experiment started last year at the Staffordshire Farm Institute. In this case the soil is a sandy loam, and while phosphates alone has produced practically no apparent result, either in the herbage or in the amount of milk produced from the plot, the addition of potash with an equal amount of phosphates increased the yield of milk by 200 gallons over the untreated plot, or at the rate of 60 gallons more per acre. It is important to note that the increased yield of milk from the plot which received both phosphates and potash was due to the greater stock-carrying capacity of the plot in consequence of the stimulation of clovers and finer grasses by the joint action of the fertilisers.

Another point on which light is required is the cause of the much closer grazing of plots of grassland which have been dressed with potash. This has been observed even in cases where phosphates alone have brought up a certain amount of clover, but the plot receiving potash in addition generally receives the most attention from the stock. A dressing of potash has also been found to sweeten coarse grass and cause it to be eaten down by stock much more readily. In what way the potash improves the pallatility of herbage, whether by the production of sugar or some other bodies, is also a question well worthy of investigation.

The Use of Lime in Agriculture and Horticulture

N. V. S. Knibbs, B.Sc., F.C.S., etc.

Lime is one of the oldest agents applied to the soil to increase its productiveness, and in the following article the author deals with the modern knowledge of its effects on the bacteria in the soil.

There is a saying amongst farmers to the effect that lime enriches the father at the expense of the son, the implication being that it temporarily induces high fertility followed by rapid exhaustion of the soil. A hundred years ago the practice of liming was almost universal—the result of centuries of experience—and one therefore hesitates to accept the implication without closer examination. It is true that the use of lime fell into disrepute when artificial fertilisers were introduced, but this was due to a misunderstanding, and further research, together with the rough testimony of practical experience (delayed for many years owing to the heavy store of lime in the soil) has shown that such fertilisers generally increase, rather than diminish, the need for lime.

The Control of Fertility.

The soil processes which control fertility are exceedingly complicated. In the early days of the rapid advance in agricultural science—the period associated particularly with the names of Liebig, Lawes, and Gilbert, and Ville—the chemical theory held the field. This simple theory claimed that the factors controlling fertility were simply the concentration of the various constituents of the soil which are shown to be necessary for growth by their presence in vegetation. Nitrogen, phosphorus and potassium are the predominating elements required, and their supply in the form of chemical fertilisers was thought to be sufficient to maintain fertility indefinitely.

The importance of soil micro-organisms in soil fertility was first brought to light in connection with the process of nitrification—the oxidation of ammonia to nitrates. Plants do not take up nitrogen in the form of ammonia, except perhaps to a very slight extent, and it was known that ammonia was changed to nitrate in the soil although no similar reaction could be brought about chemically under similar conditions. The discovery that the reaction was brought about by micro-organisms, and their isolation in 1890, gave a tremendous impetus to soil research, and it was followed by the solution of the problem of nitrogen fixation by leguminous plants and the discovery of a large number of other organisms which play an important part in the soil processes.

Essential Bacteria

It is now known that the bacteria in the soil are essential to plant growth and fertility. These organisms are very sensitive to changes of temperature and the chemical nature of their environment. Bacteria which flourish in a neutral or very mildly alkaline medium can not live in a faintly acid medium, and bacteria which require access of air to the medium in which they live (aerobic bacteria) are inactive if the supply of air is cut off either by the soddenness of the soil, overlying water, or other cause. Nearly all soils, especially on high ground, tend to become acid on account of the lime taken away in the crops (a comparatively small amount), the washing out of lime from the surface soil and the use of fertilisers such as ammonium sulphate. The change in the chemical condition of the soil is a very gradual one, but its influence is soon shown in a change in fertility due to the depression in the activity of the micro-organisms. Decay of vegetable matter is arrested, and an infertile matte of undecayed matter is formed (peat is an extreme instance), the nitrifying organisms are inactive, and nitrogen fixation by legumes is brought to a standstill. The sensitivity of leguminous plants to acid soil conditions may be used as a test of the condition of a soil.

Soil is colloidal in its properties. The texture and workability are influenced profoundly by small quantities of electrolytes. A clay or fine silt soil becomes sticky, sodden and difficult to work when it is acidic, and consequently the activity of aerobic bacteria suffers. Since nearly all the micro-organisms which are beneficial to fertility are aerobic, it is evident that fertility must suffer in this way from acid soil conditions and the depressing effect of acidity on such soils is therefore twofold.

Correcting Acidity

The only corrective to such acidity that can economically be applied is some form of lime—using the term to include burnt lime, hydrate, and any form of carbonate. Our ancestors used it without knowing why, but now every year teaches us some new reason for its profound influence on fertility. We are also in a position to understand the fallacy underlying the saying quoted at the beginning of this article. Lime, by hastening the soil processes, increases fertility, and naturally it exhausts the soil of plant nutrients if these are not returned to it by manuring. If fertility is to be maintained more manure must be added when lime is used than without it, but the return in crops of course outweighs the extra expenditure on manure. The result of using lime is, in fact, to increase the productivity of the land, and when more is taken out of it more must be put into it.

In comparatively recent years the importance of the soil fauna has come to be recognised more clearly. The soil protozoa check the increase of the beneficial bacteria, and hence an undue increase in their numbers is attended by a decrease of fertility. The "sickness" of hot-house soils is due to this, and conversely the exceptional fertility of the soil after prolonged drought or after heating it: the protozoa being more susceptible to the effects of heat and drought than bacteria, and also increasing less rapidly when favourable conditions are restored. Protozoa are also more susceptible to the influence of mild antiseptics, such as caustic lime, either hydrate or oxide, and Hutchinson and MacLennon have shown that increased fertility due to increased bacterial numbers follows the application of such under suitable conditions. This effect of burnt lime is probably not of much importance to the ordinary farmer, but it has a fundamental bearing on the use of lime to the tomato and cucumber grower. In the cultivation of these hot-house plants it is used largely, and the antiseptic property of caustic lime might be put to more account than it is. The usual practice is to renew entirely every year the soil in cucumber houses. By suitable lime treatment this might be rendered unnecessary, and research on this point would be well repaid.

The Source of Yacca Gum

Some Notes on the Australian Grass Tree

Few except those who have visited Australia know the Australian grass tree and its products, and fewer still recognize what a wonderful asset the tree is from a commercial point of view. Belonging to the genus Xanthorrhoea, it is a liliaceous plant with a thick trunk crowned with a dense tuft of pendulous, grass-like leaves, bearing numerous small flowers in cylindrical spikes. Locally, they are often called "blackboys" on account of the trunks frequently being denuded and blackened by fire. They are best known as the source of origin of acaroid or Botany Bay gum, frequently called Yacca gum in Australia. Apart from the gum, which is now comparatively well known in commerce, the tree possesses various other constituents valuable in trade.

The trees are found growing wild in many parts of the Commonwealth and flourish best on poor, rocky land. When young they present the appearance of masses of coarse rushes which later on form the crown surmounting a stump which ultimately grows to a height of anything from three to twelve feet, varying according to the conditions of the soil. Frequently they attain a diameter of two feet. As the tree grows the lower rush-like leaves die and drop off, leaving successive rings of leaf bases about three inches deep around the trunk, the green leaves near the apex forming the appearance of an umbrella. The rings of leaf base are cemented into a solid mass by the gum or resin which exudes from the inside fibrous core of the tree.

In some parts there are many thousands of acres of blackboys to be seen, but they attain the greatest size on Kangaroo Island, about ninety miles south of Adelaide, their gum-producing qualities being greater here than in other parts. During the past few years serious efforts have been made to deal with the products of these trees on a scientific basis. For many years quantities of the gum were gathered in a perfunctory and haphazard way, which was used chiefly in the manufacture of varnish, lacquer for metalware, wood stains, linoleum manufacture, furniture polish, and as a toothache cure, the bulk of the trade being local.

A Source of Poison Gas

Several years before the war, however, Germany commenced purchasing the trees themselves and shipping them to Hamburg. Year after year the trade grew until it reached large proportions, and it was ultimately discovered that they were destined to produce poison gas of a deadly nature. By destructive distillation of the leaf bases, after removal of the gum, a dark brown oil is produced which provides splendid illuminating gas. Although unequalled as an illuminant, the effect of its inhalation is disastrous to throat and chest, inducing intense fits of coughing. The war with its far-reaching effects, showed the use of the plant in other ways, since an excellent fast dye for silk, cotton, and woollen fabrics and for wood, bone, etc., is now being manufactured from the gum. Practically every colour is produced, the most successful results being in various shades of brown, yellow, green, blue, black and red.

The old methods of collecting the gum, which still prevail in many parts of the country, were to chop off the outside portion of the leaf bases sufficiently deep to ensure their easy separation when they fall into a hessian receptacle placed at the foot of the tree. The leaf bases and gum are then separated by shifting and winnowing. Secured in this way the gum is of two grades, two-thirds being coarse, about the size of a pea, and the remainder as fine as sand. Under such conditions seldom more than half the gum of a tree is obtained whilst, due to the chopping operations, a considerable amount of fine fibre permeates the gum, reducing its value, since it prevents any fixed standard being arrived at on which to sell.

The more scientific methods of handling previously referred to have resulted in greatly increasing the volume of trade. A new process has been invented by the manager of a factory recently erected to deal with the production on Kangaroo Island, whereby the gum is secured by being steamed out of the leaf under low pressure, and, running into bags, settles in a pure concentrated lump. This has resulted in fixing a selling standard, effectually disposing of all opportunities for dispute as to quality. The analysis of the concentrated gum is as follows :—

	Per cent.
Resins (matter soluble in alcohol)	91
Woody matter (insoluble in alcohol)	0·5
Moisture and undetermined	8·1
Ash	0·4
	100

Further advantages of the method are about 50 per cent. saving in space in shipping, whilst owing to the solidity there is no loss in the outrun as is the case when in loose form. A further patent is being or about to be exploited with the idea of extracting the gum direct from the tree as it stands, it being maintained that this can be done not only without causing injury to the growth of the tree, but with beneficial results due to the warming influence of the steam, which energizes the tree and causes it to immediately produce more gum.

An Aromatic Resin

A pamphlet issued by the Government says : "The Yacca gum belongs to the high priced aromatic resins, such as gum benzoin, dragon's blood, etc., rather than to the commoner varnish resins. The high yields of picric acid on nitration and of para oxy-benzoic acid on alkaline fusion indicate a chemical constitution for the resin of an oxygenated benzene derivative, and among such derivatives are numerous fine chemicals of daily use, photographic developers and materials used in the preparation of dyestuffs."

Besides the gum, every part of the tree is of value. The pith produces a kind of edible starchy substance greatly appreciated by the natives. A sweet sap is bled from the inside core, which of itself quickly ferments and can be turned into a strong alcoholic beverage, but if allowed to take its own course produces a substance greatly akin to rubber, affording an excellent roofing material. The inside core contains a coarse flat fibre running round, across, and along the trunk, which it is claimed will be of great value in paper making. The oil distilled from the leaf bases is valuable as a timber preservative, when used as a dressing rendering the trees impervious to the depredations of all destroyers such as white ants, borers, etc. Once regarded as a pest the tree is likely to take its place as one of the most useful of all wild trees, due to the multiplicity of its products.

The writer at one time experimented with Yacca gum and succeeded in producing a substance resembling tar. A few months after the State government analyst reported that he had succeeded in making both tar and alcohol from the same source. The production is now being dealt with by men skilled in scientific research.

Dr. Wertheimer's Investigations on Water Divining

At a meeting of the Bristol and South-Western Section of the Institute of Chemistry, Dr. J. Wertheimer gave an account of some experiments made on "water diviners," persons who believe that by the use of a rod they were able to locate the presence of water or metals. He said there was abundance of well-authenticated evidence that "dowsers" or "jowsers," as water-finders are termed in the West of England, had repeatedly indicated spots where good supplies of water have been found, as recently at Bath. The object of Dr. Wertheimer's experiments, the conditions for which were arranged beforehand, was to ascertain whether or not the indications of the rod were caused by any influence outside the dowser or whether he unconsciously gave indications not caused by anything external to himself. Experiments were described which dealt mainly with the finding of water and gold or silver by diviners, some of whom used a twig and others a watch-spring, and one of the best diviners, neither twig nor spring. His opinion, based on the results of experiments, was that the motion of the dowser's rod and the sensations which he experienced were not due to any cause outside himself. On the other hand, he believed that when the diviners with whom he experimented stated that they did not cause the rod to move they were saying what they believed to be the truth, but were unconsciously misleading themselves.

The Ramsay Memorial Laboratory

Inaugural Lecture by Professor Williams

Sir Robert Robertson, F.R.S., presided at the public inaugural lecture on "The Aims and Future Work of the Ramsay Memorial Laboratory of Chemical Engineering," at University College, Gower Street, London, on January 17. There was a large attendance of men and firms who have interested themselves in the question of the training of chemical engineers.

Professor Williams gave a definition of what he considered a chemical engineer to be. His definition was "a scientific man whose duty it is to plan the large scale commercial operation of chemical processes, and to design and operate the plant required for the carrying out of the chemical reactions and physical changes involved." This was rather different in form from the definition adopted by the Institution of Chemical Engineers, but it introduced nothing which the latter did not imply, and he used it because it stressed the planning of the operation itself as well as the actual design of plant.

In the course of years a chemist whose outlook was sufficiently broad and who had the initiative to apply his scientific training to the innumerable problems which presented themselves in the operation and design of industrial plant should become a first class chemical engineer. The same applied to the engineer who would endeavour, with sympathy and understanding, to grasp the fundamental ideas and see through the eyes of the physical chemist. The chemists who achieved this were extraordinarily few, and proportionately valuable. The engineers who achieved it were fewer still, because they had the harder task of acquiring the viewpoint of the chemist.

Science Employed for Profit Making

The two primary factors which differentiated the field of a chemical engineer from that of the academic chemist were the increased scale of operation and the necessity for working commercially, *i.e.*, for profit. As to the question of working for profit, he wanted to make one point very strongly for those who were leaving the atmosphere of the university for that of the works, namely, that genuine scientific work devoted to the purposes of producing a dividend was neither a poor thing as science nor a degradation of science. Cost of production should be looked on as simply another variable in their scientific investigations, just as pressure, temperature or concentration were variables—and a very interesting variable it would prove to be. This did not mean that scientific investigation was, therefore, crabbed or confined, but it meant that one had to take into consideration facts which, in the laboratory, it had been possible and convenient to ignore. It was not unscientific to attempt to use water, because it was cheap, as a solvent, where, in the laboratory, one would use ether, or iron or wood where one might use porcelain. The production of fine materials cheaply was the ultimate object of the chemical engineer, and every channel by which expense was incurred must be minutely explored.

The lecturer then went on to discuss problems arising from the increase of scale of operation from that of the laboratory to that of industrial magnitude—the change in the type of apparatus, the alteration of methods for transference of material from vessel to vessel, and so on. It was the physical aspects of the particular process which most vitally concerned the chemical engineer in his design and arrangement of plant. The chemical reaction *qua* chemical reaction, should have been worked out before the process came into his hands, and he should be in a position to assume that on the purely chemical side all the information he required would be forthcoming. Nevertheless, there were several points, even from the purely chemical point of view, that he might investigate, such as the effect of using different materials for the construction of vessels, the use of alternative materials in the process itself where advantage would be gained from the chemical engineer's point of view.

Need for Chemical Engineers

In the course of his remarks, Professor Williams referred to the necessity for a quantitative study of energy relationships in the first place, and of energy transference in the second, which was so essential to efficient plant design that without it some extraordinary failures had occurred. One example, within his own experience, was as follows: A product was to be sulphonated at a high temperature, and the final reaction mixture so obtained then nitrated by the addition of nitric acid at a low temperature. In the laboratory, and even on a small semi-scale plant, everything went well. The hot limpid solution, the product of the sulphonation stage, was cooled to the desired temperature—about 20° C.—and the nitrating acid trickled in, the heat of nitration being taken up by surrounding the vessel with cold water and agitating the contents continuously and vigorously. Good mixing and good cooling contact were secured, and a gentle progressive nitration was, in the laboratory, the invariable result. A large scale plant was then designed on similar lines, to operate, so far as he recollected, on some 2 tons of material. In the first place, the agitation was not quite so good comparatively as in the smaller vessel; the cooling surface also in a similar vessel had increased only as the square of the dimensions, while the volume, and, therefore, the heat content of the charge, had increased as the cube. This would, in any case, have resulted in a great loss of time, as nitration could not proceed faster than the heat was dissipated; and time, of course, was money. But there was worse to come. The limpid fluid, when cooled, was a supersaturated solution, and, unless nitrated within a comparatively short period, was capable of setting to an almost solid, paste-like mass. The agitation was not so vigorous as it should have been, with the result that the film in contact with the cold walls of the vessel became super-cooled and pasty long before nitration could even be started, greatly reducing such heat removal as there was. The final result was that nitration had to be conducted in a thick pasty mass, into which the acid could not be properly mixed, and the operation required some three to four times the period estimated. The nitration process itself was inefficient, and yielded an impure product, while the whole of the remaining units of a large and complicated plant were working to only 25 to [illegible] per cent. of their capacity, with the result that the ultimate cost of production was nearly double what it should have been.

It was not just horse sense that was required to prevent errors of this kind, as it was sometimes claimed. Horse sense would accomplish a good deal, however, and he would go so far as to say that frequently horse sense, combined with a little chemical and engineering knowledge, had achieved more than an encyclopædic knowledge of chemical or engineering theory, with no ability to apply it.

Having indicated how inseparably plant design was bound up with the fundamental physical and physical-chemical properties of the materials and reactions involved, the lecturer went on to discuss what was required of the chemical engineer from the more engineering point of view. Engineering, he said, had been described as applied physics. If to both sides of the equation we added chemistry, we found that chemical engineering was another term for applied physical chemistry, a definition which was due, in the first place, to Professor F. G. Donnan.

Professor Williams then proceeded to outline the nature of the courses which would be given in the Ramsay Laboratory. These would occupy two years, the first being devoted to chemistry, physics, mathematics, and engineering, the second to the investigation of practical problems. Before entering the laboratory students would require to graduate in either chemistry and physical chemistry, or engineering.

Dr. T. Gregory Foster (Provost of University College) publicly welcomed Professor Williams on his appointment to the new chair.

Recent Wills

Mr. Richard Redfern, of Waterhouse, Adlington, Chorley, retired engineer and dyeworks manager	£18,262
Mr. William John Leonard, of Lindfield Gardens, Hampstead, senior partner of Carless, Capel and Leonard, the Hope Chemical Works, Hackney Wick	£389,023
Mr. Ralph Jameson, of West Bank, Oxbridge Lane, Stockton-on-Tees, Durham, late secretary and commercial manager at Dorman, Long and Co., Ltd., Middlesbrough Iron Works	£17,428

The Chemistry of Colloids

Cantor Lecture by Dr. E. K. Rideal.

"Colloid Chemistry" is the subject of a series of three Cantor lectures which Dr. E. K. Rideal is delivering to the Royal Society of Arts, London, the first of which was given on Monday.

In this lecture, Dr. Rideal said that during the last decade the chemistry of colloids had become increasingly important. The term "colloid" was introduced by Thomas Graham in 1861; he distinguished colloidal substances from crystalline materials by the relatively rapid rate of diffusion of the latter class of substances, and believed that the distinction between a crystalloid and a colloid was a fundamental one. It had been found, however, since then, that Graham's original classification was by no means correct. A great many colloids had been found to be crystalline, and further, the rates of diffusion of all particles in a medium obeyed the same fundamental laws, whether those particles were sub-microscopic in size, like the simple molecules, or clearly visible, even to the naked eye, such as coarse suspensions.

The Nature of Adsorption

The fundamental property which imparted to colloidal systems their peculiar characteristics was exhibited most clearly by the property of adsorption. Adsorption was purely a surface effect, and therefore, any materials which exhibited a large specific surface had colloidal properties. When we inquired further as to the cause of the property of adsorption exhibited by interfaces, we found that we must attribute to liquid and solid surfaces a certain surface energy. In the case of liquids it was relatively simple to demonstrate and measure this surface energy. The fact that soap bubbles or small drops of liquids took up, when in a position of equilibrium, a perfectly spherical form indicated that some force was operative in causing both drops and bubbles to present the minimum of surface compatible with their volume. It was also clearly evident, in a quantitative manner at least, that the molecule in the interior of a liquid was attracted by its neighbours, by the forces of cohesion, equally in all directions, whilst a molecule at the surface was only attracted downwards and laterally; thus, the surface energy of a liquid was closely related to the forces of molecular cohesion. There was, as it were, an unbalanced force, which we could measure, and that was called the surface tension. Solids also exhibited surface tension which could be computed indirectly.

Selective Adsorption

Discussing selective adsorption, the lecturer said that as the forces of adsorption were intimately connected with the forces of cohesion, and were thus chemical in their nature, we should expect that all substances were not adsorbed with equal facility. There was a preferential adsorption for those substances in which the reaction of adsorption proceeded with the greatest decrease in the full energy of the system. Thus, if silica gel were exposed to a mixture of hydrogen and benzene vapour, the benzene would be more readily adsorbed than the hydrogen. Similarly, carbon monoxide was more readily adsorbed by metals than hydrogen, but both gases were actually adsorbed. In solutions also, selective adsorption occurred, not only at the air liquid interface, but also at interfaces produced on the insertion of a solid in the liquid. Thus the fatty acids, various colouring matters, and many salts, were preferentially adsorbed by charcoal from aqueous solutions. In all cases, however, both solvent and solute were adsorbed. This property of adsorption from solution was made use of in purification and decolorisation processes, and was, he said, the basis of operation of the Hele-Shaw stream-line filter.

With regard to the attempts made to obtain a relationship between the concentration or activity of the material undergoing selective adsorption in the liquid or the gas phase, and the amount adsorbed, the lecturer said that the most general formula was that proposed by Freundlich, in which the relationship between the amount adsorbed X and the concentration of the solute C or the pressure of the gas was expressed by means of an equation of the type—

$$X = a\,C^{\frac{1}{n}} \text{ or } X = a\,P^{\frac{1}{n}}$$

containing two constants, a and n. A slide was exhibited, showing typical values obtained. This equation represented the results fairly closely, but was by no means entirely accurate. In some cases the phenomenon of negative adsorption was noted, the strength of a solution, instead of being decreased by passage through a layer of charcoal or bauxite, apparently became stronger, since relatively more solvent than solute was adsorbed by the material. Langmuir had shown that sometimes each atom of the adsorbent held one atom of the adsorbate, and that the surface was saturated when covered with a film only 1 molecule deep.

The work of Hardy, Langmuir and N. K. Adam, on surface tension of solutions and interfacial tensions between liquids, gave us a yet deeper insight into the mechanism of adsorption, and had shown that if we brought two liquid surfaces together a certain decrease in the free energy would take place. The action of the adsorption forces was apparently to attach the adsorbed molecule by means of a specially reactive part of the molecule, and the molecule was orientated. If we counted the number of molecules required to saturate the surface of a known area of water, and measured also the molecular volume of the substance being adsorbed, we could evidently compute both the cross-sectional area and the length of the molecule. This work, which was commenced by the late Lord Rayleigh, and brought into prominence by I. Langmuir, was now being continued by Mr. Adam, and was of great interest, owing to the fact that we could check the sizes of the molecules measured in this way by the data obtained by Sir William Bragg and Mr. Shearer with the X-ray goniometer.

Monomolecular Layers

The information derived from a study of surface tension led us to the conclusion that the molecules adsorbed at the surface of a liquid were orientated by attachment to the liquid at specific points, and that in general only one layer of such adsorbed molecules existed. There was little doubt that molecules were adsorbed on solid surfaces by similar forces, and were similarly orientated. The conception that adsorption took place at all interfaces, and that the adsorbed layer consisted of molecules orientated by attachment at certain specific points in the molecule, was finding many extremely important industrial applications.

The Action of Catalysts

Dr. Rideal then referred to a series of Cantor lectures he delivered to the Society a year or two ago, on catalysis, when it was seen that the mechanism of heterogeneous catalysis was most readily explicable on the assumption that the reacting molecules were adsorbed by the catalyst surface in juxtaposition to one another and there reacted. During the last few years the subject had received a great deal of attention, and we now knew of many cases in which adsorption did take place, but not any catalytic action. In such cases we had every reason to believe that the adsorbed molecules were orientated in the wrong way for mutual action, for, by changing the catalyst so as to effect adsorption by another point of attachment in the molecule, reaction would proceed.

The enzymes were the organic catalysts, and their catalytic activity must be interpreted in the light of our knowledge that the reactants were adsorbed on the surface of the enzyme. The numerous studies made on the rate of enzyme action had shown that such adsorption did, in fact, take place, and that the reaction velocity was affected by the strength of such adsorption. Both the inorganic catalysts and the enzymes were very highly susceptible to poisons. All substances which were more strongly adsorbed than the reactants might be regarded as poisons, but some poisons were less virulent than others, in that the adsorptive forces were weaker, permitting of their subsequent ready removal.

Apparatus for Industrial Research

A. Gallenkamp and Co., Ltd., have issued a comprehensive catalogue of nearly 300 pages, bound in cloth, containing particulars of a wide range of apparatus for industrial research. This forms part 2 of the firm's general catalogue, the first part dealing with general laboratory apparatus. Some of the specialities for which the firm is well known are described in the new catalogue. Pyrometers of various kinds, electric furnaces, electrochemical apparatus, centrifugal machines, calorimeters, viscometers and their accessories, are among the items dealt with at some length. The catalogue covers a much wider range than this, and appears to cover all that is required for experimental work of an industrial nature both for routine analytical control and research purposes.

Chemists' Claim for Mustard Gas Production

The Case for the Crown: Professor Pope's Evidence

The hearing of the claim of Dr. Levinstein and Professor Green in respect to the manufacture of mustard gas was continued at the Law Courts before the War Inventions Commission on Monday, Mr. Justice Tomlin presiding. Mr. Chaston Chapman and Mr. Norton, K.C., assisted him on the Bench. The proceedings consisted of the continued statement of the case for the Crown by Mr. J. Hunter Gray, K.C., and the evidence of Professor Sir William Pope, the first witness for the Crown. His examination-in-chief began before lunch, and when the Court adjourned at 4 p.m. Mr. Hunter Gray announced that he had only a few more questions to put. Sir William, who was in the witness box three hours and a half, was very calm and self-possessed throughout, answering the questions very clearly and being very exact in his selection of words in dealing with technical points. Though for the most part his manner was grave and unsmiling, occasionally one got a glimpse of the dry humour which he exhibits as an after-dinner speaker. He presented the perfect type of Crown witness—clear, exact, and quite unemotional. His cross-examination at the next sitting should be interesting, for Sir Duncan Kerley, the claimants' leader, has a dry and subtle quality of mind not unlike that of Sir William himself.

Crown Counsel's Statement

In continuing the case for the Crown from the previous week's hearing Mr. Hunter Gray referred to his Lordship's remark that it was necessary for him to show why it was that Blackley, the Levinstein works, was the only place producing mustard gas in July, 1918. Assuming that to be the case, however, he said it would have to be shown that the claimants rendered some assistance to the Government in the production of mustard gas, and there was no evidence to show this. There were no working books produced, but he had just been able to obtain two log books, relating to the period from August 9 onwards, and from the information in them he disputed the claimants' statement that their plant worked smoothly. They indicated that there was frequent trouble from the deposit of sulphur.

Mr. Justice Tomlin: We were told by Dr. Levinstein that there was an explosion before this date, after which there was trouble in the plant. Up to that date they had had no trouble.

Sir Duncan Kerley said that they had had no casualties except in repair work, and that these had never stopped production.

Mr. Gray said in any case that the log books for the early period were missing.

Sir Duncan Kerley: They are lost. A thorough search has been made and is still in progress.

Mr. Gray: In view of the difficulties experienced later, can you, my Lord, accept evidence of that nature, unbacked by log books?

Mr. Gray then read an extract from a log book marked "Important and Urgent," in which it was stated that unless something drastic were done in regard to dissipating the fumes, it was too much to expect anyone to stay on the plant. One of the men, stated the entry, had come in with his eyes useless, and two other men were just as bad, one having to be led home. "It is nothing short of criminal to leave things as they are," added the statement in the log book. Counsel asked if it were conceivable that such observations would be made if the plant had been working smoothly.

Claimants Produced What Was Required

Mr. Justice Tomlin remarked that that statement taken alone might have a number of explanations. The real case which the Crown had to face was that whatever the difficulties the claimants succeeded in producing what was required, while at Avonmouth (the Government factory) they were not having the same measure of success.

Mr. Gray said that Chance and Hunt had produced 2 cwt. of mustard gas on April 28, and Castner-Kellner 3 cwt. on April 19, before Levinstein's had produced anything.

His Lordship asked why these firms had stopped production.

Counsel replied that Avonmouth was intended to take over the whole production; these firms were merely carrying out experiments on the industrial scale. The French output had begun on March 15, and by the middle of May 92 tons were produced in a fortnight. Moreover, they were working at 30°–35° C., and Dr. Wilbraham had gone over to see the process.

Mr. Justice Tomlin remarked that the information from France was not used at Avonmouth, on the evidence given by Mr. Curtis.

The Question of Remuneration

Mr. Gray, continuing, said that as to the question whether the claimants were entitled to remuneration because they had once stated they did not wish it, in his opinion they were entitled to change their minds, but he would point out that it was not a matter of free will in those days as to who should be allowed to make experiments. He suggested that they might not have been allowed to do so if they had not said they were not particular about remuneration.

His Lordship remarked that so far as his recollection went it did not matter much in those days what anyone asked.

The Question of the Patent

Mr. Hunter Gray said he would show also that the production of mustard gas, alone, or mixed with sulphur even if it was not separated, was covered by Professor Pope's patent. This was for the production of ββ di-chlorethyl sulphide from sulphur monochloride. It contained the words "sulphur *may* be separated by any convenient method." He did not read that as *must*. The patent did not only refer to the preparation of the pure product.

Mr. Chaston Chapman here conferred with his Lordship, who announced that Mr. Chapman said in the opinion of the chemist the document would relate to the pure product.

Mr. Gray said that sulphur did not destroy the toxicity of the product, and it was not fair therefore to invalidate the patent on the ground that the product was not pure. The patent also referred to agitation and production at temperatures from 30° C. upwards. He submitted that there would be a good case for infringement by the claimants, as an experiment would be described showing that ββ dichlorethyl mono sulphide was obtained in crystalline form at the low temperature and proved by analysis.

Professor Pope's Evidence

Sir William Pope, professor of chemistry at the University of Cambridge, was then called to give evidence. He said he was asked by the Government to survey the possibilities for making mustard gas. He issued his first report on January 16, 1918, in which he described experiments with dry ethylene and sulphur dichloride, obtaining 80 per cent. of monosulphide product. In his next report experiments with sulphur monochloride were described. These were carried out at 70°, in glass apparatus on a shaking table to give agitation. Sulphur always separated, partly crystalline and partly in a gummy condition. The ethylene was purified by calcium chloride, but might contain some alcohol. Later experiments showed the best yield to be at 50°—60°, when it was close on theoretical. A little of the product was put in to assist the initial absorbtion of ethylene, and impure sulphur chloride was used. Iron was found to act catalytically and lead to the production of non-toxic trisulphide. Lead was not appreciably affected. The mustard gas was always distilled off from the sulphur. At lower temperatures the sulphur did not separate and the yield was lower—about 85 per cent. theoretical.

Later, said Professor Pope, the method of stirring during absorption was introduced, and this was carried out by Chance and Hunt, under his instructions given in a letter (which was produced). A temperature of 60° was employed, and the result was very successful. In one of his own experiments on February 1 a temperature of 30°—42° was used, and the sulphur did not separate, but it took twice as long to carry out as it would have done at 60°. He now knew that the presence of alcohol in the ethylene caused the precipitation of the sulphur, but its effect was less at a low temperature. This was not known until after the armistice.

Circulation of Information

The information he obtained was circulated to the Chemical Warfare Committee, handed to the French and cabled to the U.S.A. The French and Americans were proposing to set up plant to produce mustard gas by the old thio-diglycoll process at an outlay of £2,000,000, a proposal against which he had protested at the very first.

Castner-Kellner, working at a high temperature in March, had obtained, said Professor Pope, a very pure ββ dichlorethylsulphide which had been obtained crystallised and photographed in that state. They could make 4 cwt. a week under their limited conditions.

A Secret Patent

Professor Pope said that the specification for his patent was drafted in February 4, but there was some delay, as it was necessary for the specification to be kept secret. The rights of working the patent were held by the Secretary of State for War. It was drawn up urgently, and referred to the reaction by which all the mustard gas was produced in this country.

After April he and Professor Gibson continued their experiments and verified their results, but it was largely left to the technical people to follow up.

Mr. Justice Tomlin: What was your method or process?

Professor Pope: At that stage we had discovered that a certain reaction proceeds at all temperatures from the ordinary up to 60° or 70°, and we had also discovered points regarding the reaction. We had found that we could obtain a satisfactory yield at 60° and over, and we had done everything necessary for the filing of a specification. After that we should have had nine months to work out further details before making our patent application, but having regard to the urgency of the whole thing we sent out such information as we had obtained to numbers of people. To that extent we were forced to disclose in a very premature way what we had actually discovered, but we had at that time settled that a particular reaction was a uniformly effectual one, and it is the reaction by which all mustard gas in this country has been produced.

Mr. Justice Tomlin: You had not ascertained then what were the conditions which determined when you were going to get the sulphur in solution or separate?

Professor Pope: Beyond this—that at 30° there was no sulphur, but that at higher temperatures there was some.

Mr. Justice Tomlin: You now know that the presence or absence of alcohol was the determining factor?

Professor Pope: Yes; but that was only discovered after the armistice.

Mr. Gray: At a temperature of 30° with violent agitation you had no difficulty in producing mustard gas?

Professor Pope: No.

Mr. Gray: With respect to the claimants' five points, was there any one of the five which was new to you?

Professor Pope: None of them were new. Some of them were the ordinary precautions any competent chemist would take, and there was nothing novel about any of them.

Visits to Blackley.

Professor Pope, continuing his evidence, said that he had had an interview with Professor Green on April 10. He had described the method of making mustard gas to him. On May 17 he had had a second interview, in which Professor Green said that he was getting a 100 per cent. yield at the low temperature and in an iron pot.

Mr. Justice Tomlin: It is suggested that you were so sceptical about the 100 per cent. yield that Professor Green wanted you to go up to Blackley to be persuaded or converted.

Professor Pope: The only point about which I required to be converted was the 100 per cent. yield which he claimed, and to speak quite frankly, I did not believe it. I thought he must have made some mistake or got his conditions not quite right, and inasmuch as I had been instructed to help I thought it was my duty to send Professor Gibson up and go myself as soon as possible.

Mr. Justice Tomlin: You doubted whether he was obtaining the 100 per cent. yield?

Professor Pope: I doubted very much the claim that he was obtaining a 100 per cent. yield of toxic product in the manner in which he was working.

Mr. Justice Tomlin: Was the yield remarkable, in view of the sulphur being included and being obtained in an iron pot?

Professor Pope: There was nothing remarkable except the 100 per cent. yield being obtainable in an iron pot. He added that they had not then determined the conditions for keeping the sulphur in solution.

Mr. Gray: It has been suggested that you sent down Professor Gibson, not to advise them but to teach yourself?

Professor Pope: That is absolutely ridiculous.

Mr. Justice Tomlin: He did not go down to be taught; he went down to teach. His Lordship added that in any case the evidence came to much the same as that given by Professor Green, and showed that they had conferred together.

The Nature of the Blackley Product.

Professor Pope stated that on a chemical examination of the mustard gas from Blackley, 54 per cent. of ββ dichlorethyl sulphide had been distilled at the boiling point of that substance. In some of the physiological tests the Blackley product was described as producing more severe symptoms than the pure product, but the test was not really quantitative at all. He did not believe it was dichlorethyl-disulphide, as this could not be produced by any of Guthrie's methods, nor by any other means. The product was an impure ββ dichlorethyl monosulphide.

Mr. Justice Tomlin: Anyhow the Germans found it pretty effective? (Laughter.)

The hearing was adjourned till Monday next.

Deuchar v. Gas Light & Coke Co.

Judgment for the Company

On Friday, January 18, in the Chancery Division, Mr. Justice Astbury concluded the hearing of the action by Mr. John Lindsay Deuchar, a stockholder in the Gas Light and Coke Co., who had acquired his stock for the purpose of this action, and was secretary to the Castner-Kellner Alkali Co., for a declaration that the manufacture by the company of any chemical or other substance necessary or convenient for the treatment, compounding, conversion or otherwise rendering marketable any products, refuse or residue arising or produced by the making of gas by the company, or the erection by the company of any factory or buildings for the purpose of such manufacture and erection, were *ultra vires* the company, and for an injunction to restrain such manufacture or erection.

The plaintiff alleged that the company had no power to manufacture caustic soda but must buy what they required from the chemical manufacturers.

Sir John Simon, concluding his speech for the defendant company, said the proposition was that as one of the defendant's businesses was that of converting gas into residuals, they were entitled for the purpose of that conversion to make any article required, and that this could not be said to amount to the carrying on of a separate business.

Judgment

Mr. Justice Astbury, in giving judgment, said that the point to be decided was short, but of considerable importance. The plaintiff was suing in the interest of another company, manufacturers of chemicals, of which he was secretary, to restrain the Gas Light and Coke Co. from making, as distinct from purchasing, materials required by them. The main object of the company was to make and distribute gas, but under their special Acts they had power to manufacture and sell residuary products. One of these residuals was naphthalene, from which beta-naphthol was made by treating it with caustic soda. It was admitted that the company were entitled to make beta-naphthol, and to make it with caustic soda as a reagent, and that they were entitled to buy caustic soda for that purpose; but the dispute was whether they were entitled to manufacture it.

The company said that the cost of manufacturing caustic soda would be only one-third of the price which they have to pay to buy it. A large number of authorities had been cited, but the powers of a statutory company were correctly summarised at page 11 of Buckley on the *Companies Acts* (ninth edition), where it was said that "the powers which the corporation may lawfully use in furtherance of their objects

must either be expressly conferred, or derived by reasonable implication from the provisions of the Act." This was admitted as correct by both sides, but they differed as to its application.

No evidence had been given by the plaintiff that the company had made more caustic soda than they required or more chlorine than they could use for the purpose of other residuals. It was admitted that no sale of either had been made by the company. His Lordship then dealt with the special Acts of 1868 and 1876, and said that a wide meaning must be given to the word "manufacture." The plaintiff contended that the manufacture of caustic soda was a separate business for which no power was given to the company. But if the directors deemed it necessary for carrying on their business to convert naphthalene into beta-naphthol by means of caustic soda they were entitled to do so. His Lordship then dealt with the cases which had been cited by both sides, and said that the cases of the railway companies and the London County Council, who were carrying on businesses outside their statutory powers, stood on quite a different footing. He could not see why, if the company had power to buy caustic soda, it was not quite as proper for them to make it, especially if it were cheaper to do so.

There was little to say about chlorine. It necessarily arose from the manufacture of caustic soda, and the company were by statute not allowed to store it, but must get rid of it, and if they were entitled to make caustic soda they were entitled to use the chlorine upon other residuals. It was suggested that they were going to make bleaching powder with it, but no evidence as to this had been given. The real test was not as to necessity or convenience, but whether the thing objected to was really incidental to one of the statutory objects. There was nothing in the Acts which expressly prohibited the manufacture. It was entirely fallacious to say that the making of a necessary article was a separate business. The company were in no way setting up as dealers in caustic soda, or as chemical manufacturers of it. If they were carrying out their statutory objects it was immaterial what the methods were, unless such methods were circumscribed by statute. He held that the company were neither doing, nor proposing to do, anything which was *ultra vires*, and the action must be dismissed, with costs.

Society of Glass Technology

Specifications for Glass

A MEETING of the Society of Glass Technology was held in the College of Technology, Manchester, on Wednesday, January 16, 1924, the President, Professor W. E. S. Turner, D.Sc., being in the chair. A paper by the president on "Specifications for Glass" formed the basis of an interesting discussion. Mr. J. H. Steele directed attention to a circular which he had received in which the use of glass for food containers was attacked. It was further stated that glass splinters were a possible cause of appendicitis and cancer. Mr. E. A. Coad-Pryor suggested the desirability of having some open preliminary specifications based upon durability alone. What was needed was some simple test which could be easily applied in the works. Fuller specifications could be made as experience accrued. Professor Turner in the course of his reply said that his attention had already been directed to the circular to which Mr. Steele referred. As the matter was one of some importance to the glass industry, he had felt constrained to consult some of the leading pathological and surgical experts in this country and to obtain their views on the subject. The answers which he had received very definitely refuted the charge that glass splinters were a cause of either appendicitis or cancer.

Colourless Glass for Tank Furnaces

The next paper considered was entitled "The Production of Colourless Glass in Tank Furnaces, with special reference to the Use of Selenium" by Mr. A. Cousen, B.Sc., and Professor W. E. S. Turner. Mr. Cousen summarised previous work done by the authors on this subject and gave the results of their latest experiments. Some types of commercial glass, including modern colourless glass jars, began to turn yellow when exposed for some time to light. This happened when stacks of jars were kept for a time in the open yards of glass factories. It was now shown that glasses which had been decolourised by selenium, together with arsenic, showed this yellowing effect on exposure to sunlight. On the other hand glasses which were originally yellow, due to the presence of selenium without arsenic, became bleached by sunlight. It had previously been observed that the yellow selenium glasses when reheated to temperatures of 500° to 600°C became distinctly deeper in colour, the maximum deepening being reached at a temperature of about 550°. When, however, a number of pink glasses, such as are obtained by melting batches containing selenium along with arsenious oxide or sodium nitrate, are reheated at the same temperatures distinct loss of colour occurs. This loss is slow at 525° but is very appreciable even after an hour at 575°, the upper annealing temperature of the glass itself. Such a colour change would be obtained in a lehr when the pink glasses were being annealed, and would call for careful regulation of the temperature during the process.

A paper emanating from the Department of Glass Technology of the University of Sheffield, and entitled "Further Contribution to the Study of the Effect of Alumina in Glass," was taken as read.

Consulting Chemists and Advertising

To the Editor of THE CHEMICAL AGE.

SIR,—The thanks of many chemists are, I am sure, due to the writer of the amusing article, "How Can Consulting Chemists Extend Their Practice?" in your issue of the 12th inst. I am rather afraid he cannot be a chemist himself, since he has not only a sense of humour, but even writes common sense about "the ethics of the profession." My experience of chemistry has been that it has got far too much ethics and not enough salary, and this hopeless idea about the wickedness of advertising is a case in point. Of course, it is perfectly logical, ethical and moral for "Messrs. Beaker and Flaske, Analytical, Consulting, and Research Chemists," to advertise in any way they like. At present certain chemical societies stop them doing it honestly. One such society refused to make me a member because a firm with which I was associated advertised, but in my case it was rather more complicated. I will try and illustrate the point. Supposing Messrs. Beaker and Flaske were in a huge way of business and converted themselves into a limited company, Messrs. Beaker and Flaske, Ltd., with 100 shareholders. Are poor Billy Beaker or Freddy Flaske to be refused admission to the ranks of a chemical society because, whilst perfectly qualified chemists, their firm, of which they are only directors, not in a majority, chose to advertise? This is rather a fine point, to say the least of it, but something very similar actually occurred to me in practice. Again, if the company were called, say, "General Analysers, Ltd.," would Billy and Freddy still not be eligible, because they are directors, or even shareholders?

Whilst we are on this question, what is the position of a chemist, a properly constituted member of the holy, if slightly impecunious, band undefiled by advertising, who works for a firm making, say, mechanical stokers, gas plant, or water softeners, advertising right and left in a dreadful fashion, and offering to analyse free of charge unlimited samples of coal or water "on spec." to try and get an order for a plant, thus doing the consulting chemist, whose only direct advertisement is a brass plate, out of a job?

I submit we have had enough of this tomfoolery, and that the only straightforward, legitimate, businesslike and honourable course is to allow chemists to advertise, as in America, and so do away with a whole lot of hole and corner "advertising," which is as ineffective as it is often despicable.—Yours etc., DAVID BROWNLIE.

Chemistry as an Aid to the Art Collector

A CHEMICAL examination of the pigments in a painting recently purchased in Havre, and stated to be by the artist Renoir, revealed the fact that it was not genuine. Artists were unable to settle the point, but it was known that Renoir used on a yellow pigment known as Paples yellow, while analysis showed the pigments in the painting in question to be cadmium yellow, chrome yellow, and strontium yellow. A photographic examination showed that the brush-working on the canvas differed considerably from that in Renoir's work, thus establishing definitely that the painting was spurious.

The Work of Sir James Dewar

A Critical Appreciation by Professor Armstrong

THE Friday evening discourse at the Royal Institution on January 18, by Professor H. E. Armstrong, in which he briefly surveyed the work of the late Sir James Dewar, was notable more for the information it gave as to the character of the man than for the account of his scientific attainments.

In the early part of the lecture Professor Armstrong discussed the temperamental side of Sir James Dewar, suggesting that he was probably only known to one person, and even then incompletely, viz., his wife, who alone could control him. It was recalled that some men had referred to Sir James Dewar as cantankerous, contentious, and quarrelsome, and impossible to work with, but Professor Armstrong, admitting that at times Sir James was irascible and a good hater, preferred to regard these as outward signs of inward faults to be made allowance for. As a set-off, Sir James Dewar could love very deeply, and the criticisms referred to were more or less put aside on the ground that men rarely attempted to understand one another. This portion of the lecture was interspersed with apt quotations from various writers. Professor Armstrong admitted that he himself, in later years, had found it very difficult, if not impossible, to fathom Sir James. No other man, however, was so attractive to him and none more worth studying.

Sir James Dewar was spoken of as a distinguished chemist, continued Professor Armstrong, but that was not a proper description. He was a natural philosopher of extraordinarily penetrative powers, one who could fashion with his fingers with astonishing skill. Moreover, he was a supreme judge of quality in most branches of human activity, not excluding men. He was a *virtuoso* in physical science as well as in other walks. It had been made manifest in that room, time after time, that he was the artist of artists in science, setting a high standard which he carefully guarded. No other platform in the world had borne such a great burden of discovery as the table at which he (Professor Armstrong) was speaking from that evening, and he wished to dwell on that in order to make clear the task which the community had inherited. The moral value of the work which Dewar had done at the Royal Institution far exceeded its actual value and it should be emphasised in every possible way. The morality of science must be made more widely known, because it was of far greater value to the world than its actual conquests. Dewar was the embodiment of this.

Early Days

In a few details of his early days, Professor Armstrong related that Sir James Dewar was born at Kincardine-on-Forth on September 20, 1842, the youngest of seven sons. As a lad he was fond of music and played the flute fairly well before he was ten years old. A two years' illness, however, made him give up the flute, but he took up the fiddle, learning, probably, that manual dexterity which he had in such a high degree later through his contact with the village joiner when a boy when he actually made fiddles. He went to the Dollar Academy, leaving in 1859, and going to Edinburgh with probably only his fiddle as his stock-in-trade. There he became factotum to Sir James Forbes, the distinguished professor of natural philosophy, and a great friend of Ruskin. During that period Dewar became practically the laboratory boy, and as such no doubt had access to the lectures of Sir James Forbes, whom, in later life, he held in reverent memory. Whether at this time he pursued any course of study was uncertain, but he studied mathematics, physics, etc., and when Sir James Forbes left he was chosen as assistant to Lord Playfair, who succeeded him, remaining as assistant to Professor Crum Browne later. Thus Dewar came into contact with some remarkable men. In 1877 he was appointed Fullerian Professor of Chemistry at the Royal Institution, having meantime come into association with such men as Kekulé and others.

When Dewar was at Cambridge he made no great mark. He was essentially a man of action, not built on the lines of scholarship. The result was that his great gifts were unseen, because the importance of experimental science was not then recognised. Indeed, at no time was an endeavour made to capture him at Cambridge even at the time when his fame was being spread abroad in connection with his work upon low temperature. At the Royal Institution Dewar had built himself into its fabric in a way that even Faraday never accomplished. Few could realise the fervour with which Dewar served its interests, for he rendered service not merely by his scientific conquests in the laboratory but to an extent which cannot be defined on the social side, his wife greatly aiding him. He gradually made himself a power in the outside world and attracted all sorts and conditions of men, making them not merely servants but willing slaves of the Institution. The men who aided him, unfortunately, were mostly gone. Dewar found, when he came to the Royal Institution, that he was free from control and professorial red tape regulation; he was in a Bohemian atmosphere and found an appreciative audience and a laboratory to his liking.

Professor Armstrong then referred to Dewar's work with the spectroscope, and repeated some of his experiments in this and other directions, using some of the identical apparatus used by Dewar for the purpose. Reference was next made to the liquefaction of oxygen, and the manner in which Dewar set to work to develop his appliances with very limited means at his disposal, following this up with references to and experiments with liquid air on the lines shown originally by Dewar. The importance of Dewar's work in regard to helium was emphasised by reference to the fact that airships are now filled with it, and the work recently of Professor McLelland of Toronto was also mentioned as illustrating the marked advance which had followed Dewar's early discoveries. There followed, of course, mention of the vacuum flask, and, incidentally, Professor Armstrong said he had heard Professor Bragg quite recently speak of the Thermos flask. "We will not endorse his licence this time," he added, amid laughter, "but he must not do it again." Dewar's cooled charcoal experiments were repeated, and it was added that indirectly Dewar was the inventor of the use of charcoal as a cheap absorbent material for the gas mask used in the war. Whilst referring to charcoal, Professor Armstrong said that he himself took exception to the use of the term carbon in connection with charcoal, because charcoal was a hydrocarbon and not carbon. In this way Professor Armstrong dealt with the outstanding features of Sir James Dewar's many scientific discoveries, although he was only able to touch upon a few of them, closing with a mention of his studies upon soap films.

Fluorescence of Cellulose

Society of Dyers and Colourists: Manchester Section

A MEETING of the Manchester Section of the Society of Dyers and Colourists was held on January 18, Mr. William Marshall, F.I.C., in the chair. A paper was given on "The Fluorescence of Cellulose," by Dr. S. Judd Lewis, D.Sc., F.I.C., who said that the lecture was a continuation of one delivered two years ago, and described further work carried out under the Research Scheme of the Society of Dyers and Colourists. Reference was made to the improvements in the technique employed. The nickel steel spark had been replaced by a rotating Tungsten arc, with the result that the determinations were much more uniform and precise, while the exposures had been greatly reduced. All inquiry so far led to the conclusion that the fluorescence of a body was an expression of its chemical constitution, and was but little, if at all, affected by the physical condition in which the substance was presented. The same substances, wet or dry, in form of powder, fabric or transparent film, rough or smooth, gave approximately constant results.

A new and apparently very significant feature was revealed in connection with a series of specimens of fabrics "tendered" by dilute acid, as also two tendered by exposure to daylight and two or three odd specimens. These gave curves representing high fluorescent power in the further ultra violet falling to a low value towards the visible. All other specimens give the opposite inclination. Such "inversion" is by no means uncommon, although not frequent. An example recorded two years ago is that of lactose and starch, exhibiting the same peculiarity of form, but directed in opposite senses.

The changes in fluorescent properties brought about by industrial processes were described. The lecturer appealed for the introduction of "standard samples," the various factors for which had been most carefully determined by expert workers, so as to enable those investigating some special property to correlate their work with that in other departments. Some arrangement similar to that obtaining with iron and steel was suggested.

Founders of Physical Chemistry

A Biographical Lecture by Dr. G. Senter.

At a meeting of the Northern Polytechnic Chemical Association on Tuesday in London, Dr. G. Senter, Principal of Birkbeck College, London, read a paper on "Founders of Physical Chemistry." He defined physical chemistry as the study of chemistry by physical methods, and said that this branch of science was of quite recent growth. In fact, Lavoisier was the first to introduce the use of the balance, but the growth of physical chemistry could be traced only from the time of the first researches of van 't Hoff (about 1874).

Van 't Hoff and Arrhenius

Van 't Hoff owed his fame as the founder of stereo-chemistry to an inspiration received during a short walk after a perusal of a paper by Wislicenus on tartaric acid. It was, however, his work upon osmotic pressure that was of the chief importance to physical chemistry. Here, again, he utilised previous work (by the botanist Pfeffer), and the work of van 't Hoff was of great value, not only to the chemist, but to the physiologist also. Physically speaking, the proof of the existence of an exact correlation between the gas laws and the laws of solution was of the greatest importance, but the explanation of "abnormal" osmotic pressures, observed to be shown by many salt solutions, was lacking until the work of Arrhenius supplied a key. While van 't Hoff ultimately received recognition of his value to his country, the recognition taking the form of a fine new laboratory in Amsterdam, Arrhenius had initially the greatest difficulty in getting his electrolytic dissociation theory received on its merits. He was a young man of about 24 when he elaborated this theory, and afterwards confessed, when he was appointed to teach chemistry that he had nevertheless a very deficient understanding of Avogadro's hypothesis!

Arrhenius took the step of sending copies of his thesis to many notable scientists out of Sweden, and obtained from most, notably from Ostwald, much more favourable appreciation than was shown him at home. Ostwald immediately applied the new theory to working out the well-known dilution law, which was partly modified by van 't Hoff. The theory of electrolytic dissociation also supplied van 't Hoff with the factor he sought—the constant, *i*, which regularised his "abnormal" osmotic pressure. Nernst, a co-worker with Ostwald, carried on the work so well b eun, and applied Arrhenius's theory to problems of concentration cells.

Dr. Senter said that Nernst was the least distinguished of the four in the realm of physical chemistry; his chief contribution to science being thermodynamical. Ostwald, who originated comparatively little, was a great teacher and a voluminous writer, his great merit being that he readily received and propagated new ideas. Ostwald, Arrhenius, and van 't Hoff were on the most excellent terms, and their work like their friendship, was closely interwoven.

Street and Co.'s New Address

On January 28, the well-known advertising agency, G. Street and Co., Ltd., of 30, Cornhill, will be installed in new and more commodious premises at 6, Gracechurch Street, E.C. For nearly 80 years "Street's" have been established at 30, Cornhill, the original founders at a very early date in the firm's history having taken a few rooms at No. 30. Gradually extending connection demanded more space until all the upper floors at this address were occupied. Some 50 years back extensive alterations were made including refronting of the building and the addition of another story. Owing, however, to the property changing hands, it was not possible to conclude a renewal of the lease expiring at the end of 1923; accordingly it became necessary to find other premises and these were secured in a new building at 6, Gracechurch Street, where five floors will be occupied. The building is of handsome external appearance, and contains ample floor space, and will make an adequate home for "Street's," who, by the way, are in their 93rd year of existence. It is situated at the Cornhill end of Gracechurch Street next to the Hong Kong Shanghai Banking Corporation, while an entrance with service lift is situated in Corbet Court.

Chemical Matters in Parliament

Sale of German Dyestuffs.

Mr. Waddington (House of Commons, January 17) asked the President of the Board of Trade whether the negotiations now taking place between representatives of the German dyemakers' combine and the British Dyestuffs Corporation are for the purpose of establishing a working agreement under which the British Dyestuffs Corporation shall become the agent of the German dyemakers for the sale in this country of German dyestuffs; and whether the directors appointed to the British Dyestuffs Corporation by the Government have received authority from the Board of Trade to support these negotiations.

Viscount Wolmer: Negotiations have been proceeding for a considerable time past between the British Dyestuffs Corporation and German dyemakers. The Board of Trade have approved of these negotiations taking place, as a satisfactory agreement would, in their view, increase the efficiency of the dyemaking industry in this country. Negotiations are still proceeding, and I think it would be prejudicial to all the interests concerned to make any detailed statement at present.

Asymmetric Synthesis

Professor McKenzie at the Aberdeen Chemical Club

An open meeting, under the auspices of the Aberdeen Chemical Club, was held in the Chemistry Department, Marischal College, on Friday, January 18, Professor Alexander Findlay taking the chair. A paper was read by Professor Alexander McKenzie, F.R.S., on "Asymmetric Synthesis." The invitation of an outside speaker was an innovation at the Club.

Wöhler's discovery in 1828 that urea could be obtained in the chemical laboratory by a process different from that which occurred in the living body marked, he said, the opening of a new era in organic chemistry. Since that time chemists had been interested in the preparation of naturally occurring products, and much success had attended their efforts. The experimental methods employed were, however, far from being identical with those of Nature, which did not require the use of reflux condensers and of elevated temperatures. Many optically active substances occurred in Nature as products of plant and animal metabolism. They had, for example, such compounds as dextro-glucose, laevo-asparagine, laevo-malic acid and, above all, the optically active proteins which were of so great importance physiologically. The term "Asymmetric synthesis" was introduced by Emil Fischer in the course of his attempts to account for the occurrence of bodies such as those. Thus, in the case of the formation of sugar in plant growth, the assumption was made by Fischer that chlorophyll, which was presumably optically active, exerted a directing influence on the condensation of formaldehyde of such an order that a one-sided action occurred, and sugar appeared in the optically active form. An intermediate compound was presumably formed, from which the original chlorophyll complex was disrupted to give the active sugar. In Nature the directing agents were generally enzymes, and the constitution of these was not only complex but indeed unknown.

The lecturer had attempted to imitate in the laboratory the method which Nature carried out ever so much more smoothly and effectively. In one respect his results had been satisfactory, since they had given the experimental evidence of the validity of Fischer's reasoning, inasmuch as asymmetric syntheses had been conducted with compounds of known constitution as the intermediary agents. The most successful asymmetric synthesis was that of laevo-atrolactinic acid, and this was described in detail. The lecturer also gave an account of the asymmetric synthesis of other substituted glycollic acids, and of the lactic and tartaric acids. In those cases the directing agent was generally either menthol or borneol. The chief interest of the work lay in the isolation of optically active acids after the directing group had been introduced and then eliminated. Reference was also made to the combination of benzaldehyde and hydrogen cyanide in the presence of emulsin as studied by Rosenthaler.

Discussion followed, and the meeting closed with a hearty vote of thanks to the lecturer, moved by Professor Findlay.

From Week to Week

THE MIDDLESBROUGH CORPORATION has decided to accept a French tender for cement, as it is the lowest of 21 received.

MR. J. E. AESCHLIMANN, a chemical research worker at Trinity College, Cambridge, has received the degree of M.Sc.

AT THE LAST meeting of the Royal Microscopical Society, Mr. A. Chaston Chapman, F.R.S., President of the Institute of Chemistry, was elected president for the coming year.

RENNACID CASEIN, LTD., announce that their offices have been removed from 16, Philpot Lane, E.C.3, to 11, Poultry, London, E.C.2, and their telephone number changed to City 8233.

THE TRENT IRON CO., LTD., which put the first furnace into blast at Scunthorpe, celebrated its "diamond jubilee" on Wednesday. To-day there are 24 blast furnaces in the district.

A SUB-COMMITTEE of the Gas Committee of Edinburgh Town Council on Thursday, January 17, resolved to recommend the introduction of vertical retorts at Granton Gasworks for the manufacture of gas.

THE COUNCIL of the British Cast Iron Research Association has appointed Mr. J. G. Pearce to the post of director, in succession to Dr. Percy Langmuir, and Mr. J. E. Fletcher to the post of consultant to the Association.

THE ROSARIO NITRATE CO. has appointed Lord Cullen of Ashbourne as chairman in place of Mr. Thomas V. Anthony, who has retired from business life. Mr. Henry V. Anthony has also been appointed a member of the board.

THE FIRE-LIGHTER WORKS belonging to Mr. M. Stanway, at Shelton, Stoke-on-Trent, was completely destroyed by fire on Thursday, January 17. The fire is believed to have been caused through the boiling over of a vessel containing creosote.

A COASTGUARD, while examining a cylinder 42 in. in length with a 30 in. diameter, which had been washed ashore at Great Yarmouth, had a narrow escape from asphyxiation from fumes coming from a leakage. The cylinder contained chlorine gas.

THE ANNUAL MEETING of the Leeds University Mining Society, at which it was announced that Mr. W. Cullen would lecture on "Practical Hints on the Use of Explosives," should have been held on Monday, January 21, but was postponed on account of the railway strike.

PROFESSOR NIELS BOHR, who is in charge of the laboratory at Copenhagen where Messrs. Coster and Hevsey discovered the element hafnium, is reported to have received a gift of $40,000 from the Rockefeller International Education Board, for the purpose of modernising and adding to the equipment of the laboratory.

A FIRE occurred on Thursday, January 17, at Burght, which faces Antwerp on the left bank of the Scheldt, at a depot containing oil and cylinders of oxygen belonging to an English company, the Cannon and Portland Oil Co. Nobody was hurt, but the material damage was very considerable. The cause of the outbreak is not known.

SIR J. FORTESCUE FLANNERY, in his Presidential address to the Junior Institute of Engineers, on Wednesday, January 16, stated that oil was superseding coal as a means of marine propulsion, but how soon chemists would be able to extract the heat-producing constitutents of coal, and present them in liquid form to the marine engineer, he could not say.

AT A DINNER and social gathering held on Friday, January 18, at Southport, in connection with the Liberal celebrations of the return of Sir John Brunner as M.P. for Southport, it was stated that Sir John was prevented from attending by indisposition. Lady Brunner was absent for a similar reason. They are both at Sandeway Hall, Sir John's residence near Northwich.

A SHORT HISTORY OF BIRKBECK COLLEGE, by O. Delisle Burns, will be published at an early date by the University of London Press. The volume contributes an interesting chapter to the history of English education, tracing the remarkable evolution of Birkbeck from the first London Mechanics' Institution to its admission a century later as one of the colleges of the University of London.

THE NEW PRESIDENT of the American Institute of Chemical Engineers is Dr. Charles L. Reese, who after sixteen years' experience as a teacher of chemistry, joined the Du Pont Company, and has spent the last 21 years in their service, first as the head of a small chemical research laboratory, later as chemical director in charge of very large developments, and finally as a member of the board of directors.

THE SOCIETY OF CHEMICAL INDUSTRY, in a circular to members, states that the Society has lost a considerable number of members during the last few years owing to lack of employment and other causes. The Council appeals to members to assist in obtaining new advertisers "as an increase of income from this source is of urgent importance in view of the cost of publishing the journal in its present form."

MR. H. M. SPENCER, a research chemist at Cornell University, U.S.A., claims to have found a chemical substance which will purify ocean water polluted by oil-burning vessels and waste water discharged by works. He gave a demonstration before industrial engineers and Public Health Service officials, at which he treated samples of discharged water from paper and silk mills with the chemical, with the result that it became perfectly clear after filtration.

THE NUMBER OF PERSONS on January 14, 1924, recorded on the Live registers of the Employment Exchanges in Great Britain was 1,220,400. This was 7,306 less than on January 7, 1924, and 265,478 less than the figure recorded on January 1, 1923. In addition, the number working systematic short-time and drawing benefit for intervals of unemployment was 52,600 on January 14, 1924, as compared with 53,802 on January 7, 1924, and 56,261 on January 1, 1923.

A MEETING of the Edinburgh and East of Scotland section of the Society of Chemical Industry was held on Thursday, January 17, at Edinburgh, Dr. Alexander Lauder in the chair. Major R. Bruce, F.I.C., read a paper on "Recent Work on Gelatine." After giving a general description of the modern processes for the manufacture of gelatine, Major Bruce discussed some of the recent researches of American and British workers, and referred to research work which had been carried out in Edinburgh.

MR. WILLIAM JOHN LEONARD, of Hampstead, N.W., senior partner in Carless, Capel and Leonard, the Hope Chemical Works, Hackney Wick, left £389,023. He gave over £26,000 to charity, his bequests including £10,000 to establish in the neighbourhood of Hackney Wick an institute or club for those employed in factories or workshops; £5,000 to Clifton College, Bristol, for scholarships in his name; and £1,000 each to the Poplar Hospital, Dr. Barnardo's Homes, the London Hospital and the Salvation Army.

"The Hardware Trade Journal" Jubilee

CONGRATULATIONS are due to *The Hardware Trade Journal*, which issues its Jubilee Number to-day. The story of this journal is the history of the marvellous development during the last fifty years of all those things which are included in the term hardware or ironmongery, and without which modern life would be impossible. The first number, which bore the date January 31, 1874, consisted of a single sheet. A year afterwards it had grown to four pages, and by 1876 to twenty pages. It was then published in Birmingham, the centre of the industry. Important though the developments in the building up of *The Hardware Trade Journal* were during its first twenty-seven years they are completely overshadowed by those that have taken place since the beginning of the twentieth century. Industrially and commercially there has been tremendous expansion. In March, 1900, the journal passed into the hands of Benn Bros., and was published in Finsbury Square. Very quickly there was concentration on building a bigger and more powerful journal, and in the following year an important change was the conversion of the monthly into a weekly. A few years ago the growing business of Benn Brothers, Ltd., necessitated a removal to 6 and 8, Bouverie Street, where the journal and the various other trade and technical publications of the firm are now published. *The Hardware Trade Journal* is celebrating its jubilee by a special number published to-day, containing twenty articles written by experts on the development of the hardware and allied trades during the last fifty years, as well as portraits of over seventy persons and firms who have been in the business during that time.

References to Current Literature

British

CEMENTS.—Calcium sulphate cement. C. L. Haddon and M. A. W. Brown. *J.S.C.I.*, January 18, 1924, pp. 11–16T.

LEATHER.—The epilation of skins. H. C. Ross. *J.S.C.I.*, January 18, 1924, pp. 55–59.

COMBUSTION.—Detonation in motor fuels. H. Moore. *J.S.C.I.*, January 18, 1924, pp. 59–61.

PHOTO-CHEMISTRY. The physical chemistry of the photographic process. Section IV.—Absorption reactions in photographic films. The most important absorption reactions in the photographic film; nucleus isolation and desensitisation; the chemistry of the red toning of sulphide-toned prints; absorption of cupric ions on silver bromide; the theory of photographic dye mordanting. *Trans. Faraday Soc.*, November, 1923. pp. 386–402.

Some future problems in photography. J. Plotnikow. *Trans. Faraday Soc.*, November, 1923, pp. 403–405.

GENERAL.—The law of definite proportions in the light of modern research. U. R. Evans. *Trans. Faraday Soc.*, November, 1923, pp. 420–432.

SACCHARIDES.—The constitution of the disaccharides. Part IX. Gentiobiose: its identity with amygdalin biose. W. N. Haworth and B. Wylam. *Chem. Soc. Trans.*, December, 1923, pp. 3120–3125.

The constitution of raffinose. W. N. Haworth, E. L. Hirst and D. A. Ruell. *Chem. Soc. Trans.*, December, 1923, pp. 3125–3131.

TAUTOMERISM. The tautomerism of amidines. Part III. The alkylation of open-chain amidines (*continued*). F. L. Pyman. *Chem. Soc. Trans.*, December, 1923, pp. 3359–3375.

PIGMENTS.—The chemical constitution of bacterial pigments. Part I. The isolation of pyocyanine and the preparation of its salts. H. McCombie and H. A. Scarborough. *Chem. Soc. Trans.*, December, 1923, pp. 3279–3285.

REACTIONS.—Diazo transformation of amino-coumarins and amino-naphthapyrones. B. B. Dey and H. Dalal. *Chem. Soc. Trans.*, December, 1923, pp. 3384–3392.

The interaction of primary amines and 2-dithiobenzoyl. E. W. McClelland and J. Longwell. *Chem. Soc. Trans.*, December, 1923, pp. 3310–3135

TEXTILE TREATMENTS.—Investigation into the changes which occur in cotton fabrics during callendering and beetling. J. Huebner and V. Malwin. *J. Soc. Dyers and Col.*, January, 1924, pp. 5–10.

The mercerising, dyeing and finishing of ramie. Part II. W. Marshall. *J. Soc. Dyers and Col.*, January, 1924, p.p. 10–14.

COLOUR.—The relationship between colour and constitution in the nitrobenzaldehyde-hydrazones. F. D. Chattaway and G. R. Clemo. *Chem. Soc. Trans.*, December, 1923, pp. 3041–3062.

United States

PICRIC ACID.—The preparation of picric acid from phenol. F. Olsen and J. C. Goldstein. *J. Ind. Eng. Chem.*, January, 1924, pp. 66–71.

Manufacture of picric acid. H. S. Reed. *J. Ind. Eng. Chem.*, January, 1924, pp. 72–74.

AMMONIA OXIDATION.—Catalysers for the oxidation of ammonia. W. W. Scott. *J. Ind. Eng. Chem.*, January, 1924, pp. 74–82.

RUBBER.—Reactions of accelerators during vulcanisation. Part VI. Organic acids and inorganic accelerators. C. W. Bedford and H. A. Winkelmann. *J. Ind. Eng. Chem.*, January, 1924, pp. 32–34.

OILS.—The action of catalysts with non-drying oils. A. H. Gill. *J. Ind. Eng. Chem.*, January, 1924, pp. 23–24.

Fluidity anomalies in refined mineral oils. E. C. Bingham, W. L. Hyden and G. R. Hood. *J. Ind. Eng. Chem.*, January, 1924, pp. 25–26.

NITRATES.—Federal investigation of the Chilean nitrate industry. *Chem. Met. Eng.*, January 7, 1924. pp. 5–9.

LIME.—Waste elimination by the rotary kiln for lime. C. Wadsworth. *Chem. Met. Eng.*, January, 7, 1924. pp. 13–16.

FOODSTUFFS.—The amino acid distribution in proteins of wheat flours. With a note on an improved method for the preparation of aldehyde-free alcohol. R. J. Cross and R. E. Swain. *J. Ind. Eng. Chem.*, January, 1924, pp. 49–52.

Vitamin C in canned foods. W. H. Eddy and E. F. Kohman. *J. Ind. Eng. Chem.*, January, 1924, pp. 52–53.

Chemical engineering methods in processing dried fruit. A. W. Allen. *Chem. Met. Eng.*, January 7, 1924, pp. 10–12.

DISTILLATION.—Fractionation of completely miscible liquids. E. J. Winter. *Chem. Met. Eng.*, January 7, 1924, pp. 18–20.

ANALYSIS.—Analysis of naphthalene sulphonic acids and naphthalene. W. S. Calcott, F. L. English, and F. B. Downing. *J. Ind. Eng. Chem.*, January, 1924, pp. 27–30.

The solvent-index of refraction method of determining oil in wax. R. E. Wilson and R. E. Wilkin. *J. Ind. Eng. Chem.*, January, 1924, pp. 9–12.

HYDROGENATION.—On the catalytic hydrogenation of certain oils. L. Kahlenberg and T. P. Pi. *J. Phys. Chem.*, January, 1924, pp. 59–70.

SOAPS.—A method of determining the detergent action of soaps. J. W. McBain, R. S. Harbourne and A. M. King. *J. Phys. Chem.*, January, 1924, pp. 1–11.

ISOTOPES.—The discovery and separation of the isotopes of chlorine, and the whole number rule. W. D. Harkins and T. H. Liggett. *J. Phys. Chem.*, January, 1924, pp. 74–82.

FERTILISERS.—Utilisation of hair and leather in the manufacture of commercial fertilisers. J. A. Skooglund. *J. Amer. Leather Chem. Assoc.*, January, 1924, pp. 11–14.

TANNING.—Contributions to the theory of vegetable tanning. Part I. Dehydration of lyophilic sols and gels by tannins and its bearing on the theory of vegetable tanning. H. G. B. de Jong. *J. Amer. Leather Chem. Assoc.*, January, 1924, pp. 14–57.

GELATIN.—The combination of deaminised gelatin with hydrochloric acid. D. I. Hitchcock. *J. Amer. Leather Chem. Assoc.*, January, 1924, pp. 2–11.

German

INDICATORS.—Theory and practice of the use of acidimetric indicators. A. Thiel. *Z. anorg. u. allg. Chem.*, December 28, 1923, pp. 159–178.

THALLIUM COMPOUNDS.—Thallic sulphate and selenate. J. Meyer and H. Wilk. *Z. anorg. u allg. Chem.*, December 28, 1923, pp. 239–259.

COMPLEX COMPOUNDS.—Constitution of the compounds resulting from the action of acetic acid and its salts on ferric chloride and nitrate. R. Weinland, K. Kessler and A. Bayerl. *Z. anorg. u. allg. Chem.*, December 28, 1923, pp. 209–225.

ANALYSIS.—Electro-metric estimation of iron and manganese simultaneously. E. Müller and O. Wahle. *Z. anorg. u. allg. Chem.*, December 28, 1923, pp. 260–264.

VISCOSE.—Study of the viscose reaction. B. Rassow and M. Wadewitz. *J. prakt. Chem.*, December, 1923, pp. 266–332.

LACTONES.—The β-lactones of β-oxybutyric acid and its alkyl derivatives, and the dependence of β-lactone formation on the constitution. H. Salkowski. *J. prakt. Chem.*, December, 1923, pp. 253–265.

CELLULOSE.—Cellulose. Part VIII. Cellulose-copperammine solutions; acetylation of cellulose; methylation of cellulose; decomposition of acetyl-cellulose with hydrobromic acid. K. Hess, W. Weltzien and E. Messmer. *Annalen*, December 22, 1923, pp. 1–144.

Miscellaneous

PEROXIDE.—The constitutional formula of barium peroxide. J. Piccard. *Helv. Chim. Acta*, December 1, 1923, pp. 1036–1038.

GRINDING.—Grinding machinery for the chemical industry. E. Blau. *Chem.-Zeit. (Vienna)*; Part I, December 1, 1923, pp. 172–176; Part II, December 15, 1923, pp. 181–183.

Patent Literature

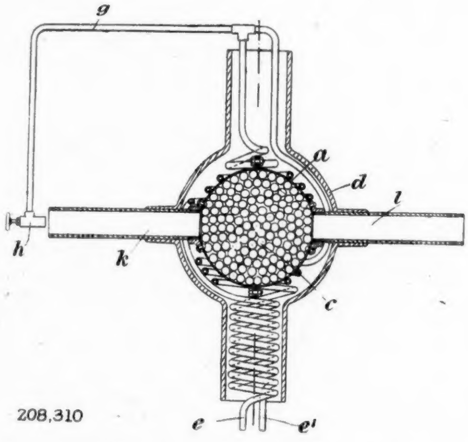
Abstracts of Complete Specifications

208,267. LUBRICANTS, MANUFACTURE OF.—Plauson's (Parent Co.), Ltd., 17, Waterloo Place, Pall Mall, London, S.W.1. From H. Plauson, 26, Jarrestrasse, Hamburg, Germany. Application date, September 29, 1922.

The process is for the manufacture of lubricants containing solid particles, especially graphite. The graphite or the like is subjected to disintegration in a high speed colloid mill such as that described in Specification No. 155,836 (see THE CHEMICAL AGE, Vol. IV., p. 313) with oil, in the presence of certain dispersators, but substantially without water. The dispersators used are fatty acids of high molecular weight, or their esters, ethers, or ketones. The acids may be employed, or waxes containing them, or other organic compounds of these acids. In an example, a mixture of graphite 140 parts, mineral oil 400 parts, and arachidic acid 2 parts, is treated for 5–10 minutes in a colloid mill, yielding a homogeneous dispersion in which the graphite is very finely divided. If mineral impurities are present, a small quantity of alkali is also added during dispersion, so that they are converted into the colloidal state. Alkali is also added when using other solid lnbricants, such as talc. Montan wax is also mentioned as a dispersator.

208,310. CRACKING OILS, PROCESS AND APPARATUS FOR. J. F. Monnot, Highwood House, Mill Hill, London. Application date, October 27, 1922.

Oil is cracked by vaporising it by heating to a high temperature at a pressure of about 50–75 lb. per square inch, and then cracking the vapour by expanding it into a chamber containing refractory material maintained at a temperature of about 500° C. A spherical or cylindrical chamber *a* is filled with



208,310

small balls *c* of refractory material such as fireclay, and is enclosed in an outer concentric chamber *d*. The chamber *a* is surrounded by thick copper pipe coils *e*, e^1. These pipes and the inner chamber *a* are heated to about 500° C. by passing hot gases through the space between the two chambers. Mineral fuel or crude oil is forced at a pressure of 50–75 lb. per square inch into the lower ends of the pipes *e*, e^1, and thence through the pipe *g* to a needle valve *h*, which injects it into the tube *k*. The oil vapour mixed with a small amount of air passes into the chamber *c* and expands, and is thereby cracked. Part of the oil combines with the oxygen, forming carbon monoxide, and the resulting mixture of permanent gas and oil vapour is withdrawn through the tube *l*. The process is particularly applicable for cracking crude oils having a specific gravity between 0·870 and 0·920.

208,569. TRANSFORMING HYDROCARBON LIQUIDS INTO LIQUIDS OF LOWER BOILING POINT, PROCESS FOR. S. J. M. Auld, 23, Great Winchester Street, London, E.C. Application date, July 20, 1922.

The liquid hydrocarbon is subjected to treatment by passing its vapour through an adsorbent substance of a very high adsorbent capacity, heated to a temperature of 400°–700° C. The temperature varies inversely as the boiling point of the liquid hydrocarbon. The adsorbent substance must be such that it is capable of adsorbing 1 c.c. of liquid benzene as vapour from air in each 10 grams of the substance; such substances are activated cocoanut shell charcoal, silica gel, and ferric hydroxide gel. The cracking may take place in the presence of free hydrogen or a gas containing hydrogen, and it may also take place under high pressure. The latter is advantageous, since the adsorbent capacity of the substance increases with rise of pressure. The pressures used are 10–50 lb. per square inch. The activity of the adsorbent substance is maintained by periodically reducing the pressure during the run, or by passing steam through it. After the substance becomes spent, it is cut out of the vapour circuit and re-activated by means of superheated steam or air. In an example, a light gas oil having a boiling point of 210°–275° C. was treated in this manner, yielding 70 per cent. of a product having a boiling point of 40°–200° C., by passing the vapour at a pressure of 30 lb. per square inch through cocoanut shell charcoal at 530°–540° C. The spirit thus obtained is similar to petrol, and does not deposit the gummy polymerisation products characteristic of cracked spirit.

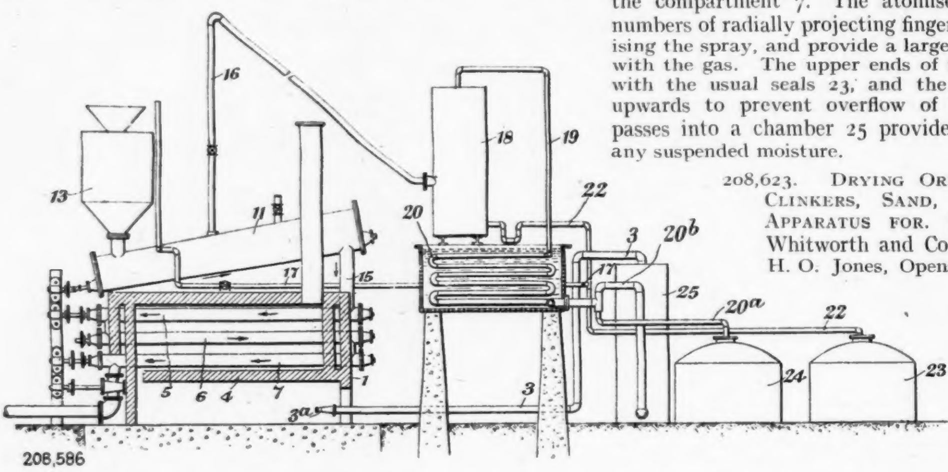
208,578. ALKALI CARBONATES, PROCESS FOR THE MANUFACTURE OF. Plauson's (Parent Co.), Ltd., 17, Waterloo Place, Pall Mall, London, S.W.1. From H. Plauson, 26, Jarrestrasse, Hamburg,. Germany. Application date, September 13, 1922.

Alkali carbonates are manufactured from alkali sulphates or insoluble alkali silicates such as felspar, by treatment with carbon monoxide at a reduced pressure. The gas may be obtained by passing air through a producer, or metallurgical gases may be used, or water gas may be used and it may be burnt with a limited quantity of air to enrich it in carbon monoxide. Superheated steam at 300° C. may also be added. The reaction is effected in a rotary furnace of the kind used in the alkali industry, the temperature being about 600°–700° C. The sulphur dioxide is removed as rapidly as possible by blowing superheated steam or inert gas through the furnace, and it may be oxidised to sulphur trioxide and used for treating sodium chloride to produce a fresh quantity of sodium sulphate. The reaction may be accelerated by the addition of 0·1–0·5 per cent. of ammonia, organic amines, or oxides of nitrogen. The reduced pressure employed is more than sufficient to produce the necessary flow of gas through the retort. Reference is directed in pursuance of Section 7, Sub-section 4 of the Patents and Designs Acts of 1907 and 1919, to Specifications Nos. 7355/1885 and 4403/1913.

208,586. EXTRACTING HYDROCARBON OIL MATERIAL FROM OIL-BEARING EARTHY MATERIAL, PROCESS AND APPARATUS FOR. D. T. Day, 715, Nineteenth Street, N.W., Washington, D.C., U.S.A. Application date, September 18, 1922.

Oil shale or sand is treated with a bath of liquid solvent oil, and is then removed and heated to drive off all volatile matter. It is found that shale that is impregnated with oil is much more readily distilled than dry shale, owing to its better conductivity. Three retort tubes 5, 6, 7 are arranged horizontally in the furnace 1 above a horizontal partition 4 which is heated by burners 3*a*. Each retort contains a screw conveyor which is rotated so that material is fed through the retorts continuously from the top to the bottom, alternately in opposite directions, as shown by the arrows. An inclined chamber 11 is arranged above the furnace, and is fed at its lower end with shale from containers 13. The chamber 11 contains a bath of hot oil, and the material is conveyed through it by a screw conveyor to the outlet 15 which leads to the receiving end of the retort 5. The shale is moved comparatively slowly through the oil, so that it becomes impregnated with oil. Any gases liberated during this treatment are drawn off through a pipe 16 to a tower 18, and liquid oil may be drawn off from the chamber 11 through a pipe 17. Gases and light vapour pass to the tower 18 through a pipe 19 and to a water-cooled condenser 20, and the condensate passes through a pipe 20*a* to a tank 24. Any remaining gases pass through a pipe 20*b* to a scrubber 25, and the residual gas from the latter passes through a pipe 3 to the burners. The heavier condensate from the tower 18 passes through a pipe 22 to a tank 23, and the pipe 17

is also connected to the pipe 22. The temperature of the retort tubes 5, 6, 7 should be about 700° F., and the temperature of the chamber 11 is about 300° F. The process may



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be conducted at atmospheric pressure, but is more efficient at a pressure of 70 lb. per square inch. The process has been successfully used in the treatment of shales obtained in California, Nevada, Colorado, and Utah.

208,632. Effecting Intimate Contact of Gases and Liquids, Apparatus for. E. Lloyd and Simon-Carves, Ltd., 20, Mount Street, Manchester, and Meldrums, Ltd., Canal Works, Timperley, near Manchester. Application date, December 8, 1922.

This apparatus is of the kind in which the gas passes through a series of compartments into which liquid is sprayed. The superposed compartments 7 are separated by partitions 8, having openings 9 for the passage of the liquid, and openings 10 for the upward passage of the gas. A vertical rotating

208,632

shaft 11 carries a water-collecting and atomising device 14. Each of these devices consists of an inverted truncated hollow cone 15, surrounded by a hemispherical gauze screen 16. The cone is provided with internal curved vanes 17 which raise the liquid from the trough and discharge it over the top on to the gauze 16, which atomises it and distributes it into the compartment 7. The atomiser is also provided with numbers of radially projecting fingers 21 which assist in atomising the spray, and provide a large wetted surface in contact with the gas. The upper ends of the pipes 22 are provided with the usual seals 23, and the openings 10 are flanged upwards to prevent overflow of liquid. The treated gas passes into a chamber 25 provided with baffles to extract any suspended moisture.

208,623. Drying Ores, Slags, Limestones, Clinkers, Sand, Chemical Substances, Apparatus for. Sir W. G. Armstrong, Whitworth and Co., Ltd., J. M. Jackson and H. O. Jones, Openshaw Works, Manchester. Application date, November 9, 1922.

A closed vertical cylindrical vessel is adapted to be oscillated on a central vertical shaft, and is fitted internally with a number of helical plates forming a continuous spiral from top to bottom. Hot gases are caused to pass upwards through the latter, and a rapid oscillation is imparted to it by means of eccentrics, to cause the material to be dried to pass slowly downwards. The dried material is removed at the bottom by a conveyor.

208,656. Catalytic Agents, Manufacture of. W. A. Patrick, The Terraces, Mount Washington, Baltimore, Md., U.S.A. Application date, January 17, 1923.

Specification No. 136,543 (see The Chemical Age, vol. II, p. 210) describes the manufacture of a hard, highly porous gel which is stable up to 700° C., and has ultra-microscopic pores capable of adsorbing gases or vapours at very low partial pressures. These gels are more adsorptive than the dried precipitate obtained from sodium silicate and an acid. Specification No. 159,508 (see The Chemical Age, vol. IV, p. 566) describes the combination of the materials which yield the gel with a substance or substances which will yield a catalytic agent in intimate association with the gel. In the present invention the catalytic gel may be obtained by treating the gel itself in substantially its final state of manufacture with the catalytic agent, provided that all the water is not removed from the gel. It is found that if the gel is too dry, the impregnating solution is absorbed so rapidly that the resulting heat destroys the granules. It is necessary to leave about 30 per cent. of water in the gel. As an example, the partly dried gel is mixed with a solution of ammonium chlorplatinate, and the mixture heated to about 300° C. The product is a gel containing finely divided platinum. In another example, the gel may be impregnated with a solution of ferric acetate, which, on heating, gradually yields iron oxide distributed throughout the gel. The gels used in this invention are such as are capable of absorbing about 21 per cent. of their own weight of water at 30° C. when in equilibrium with water vapour at a partial pressure of 22 mm. of mercury.

208,649. Electrolysing Fused Salts of Metals, and Recovering the Metals and Acid Radicles. E. A. Ashcroft, 32a, Liverpool Street, London. Application dates, January 11 and February 8, 1923. Addition to 198,024.

This apparatus consists of a number of multiple couple electrolysers or piles in accordance with Specification No. 198,024 (see The Chemical Age, Vol. VIII, p. 706). These are grouped together or combined in one tank or container, or in a number of connected tanks or containers, so as to constitute one compound electrolyser of high voltage. Each electrolyser consists of any desired number of electrodes or plates, preferably of compressed carbon or graphite, and insulated from one another by fused silica rods. The electrodes may be plain, grooved, or corrugated, or may be provided with projections on, and recesses in, the faces opposed to each other. These projections and recesses may be pyramidal, small holes being provided at the apex of the pyramid

to allow the deposited metal to drain downwards and the liberated gases to pass upwards. Insulating sheets are fitted closely all round and below the piles of electrodes to secure economy in current. The plates may be horizontal or vertical. An apparatus composed of four series of 60 couples each may be worked at 400–500 volts.

NOTE.—Abstracts of the following specifications, which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention :—201,912 (Pirelli and Co.), relating to the vulcanisation of rubber, see Vol. IX, p. 378; 202,613 (H. Vogel), relating to the manufacture of colloidal sulphur, see Vol. IX. p. 432.

International Specifications not yet Accepted

207,142. AMMONIUM CHLORIDE LYES. Henkel et Cie and W. Weber, Dusseldorf, Germany. International Convention date, November 15, 1922. Addition to 196,585.

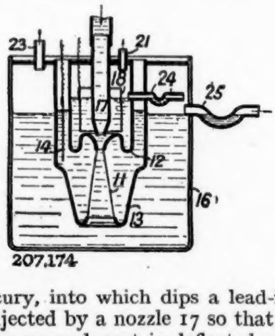
Specification 196,585 (see THE CHEMICAL AGE, Vol. VIII., p. 677) describes a method of avoiding the corrosion of iron vessels used for evaporating solutions containing ammonium chloride, such as lyes from the ammonia-soda process, by the use of zinc with or without a weak direct electric current. In this invention, cadmium or cadmium salts are used in place of zinc. In an example, a solution containing ammonium chloride 15 per cent., and sodium chloride 8 per cent. is treated with 0·5 per cent. of cadmium chloride. The wetted surface of the vessel is 7 sq. decimetres, and a current of 0·07 amperes is passed through the liquid from an iron anode to the vessel as cathode. Ammonium chloride crystals may be obtained by evaporating and cooling. In another example the addition may consist of 1 per cent. of metallic zinc and 1 per cent. of metallic cadmium, or their chlorides.

207,162. NAPHTHALENE DERIVATIVES AND DYES. Soc. of Chemical Industry in Basle, Switzerland. International Convention date, November 18, 1922.

1 : 8-naphthsultone is treated with highly concentrated ammonia for a long time at a low temperature, under which conditions the saponifying action is small compared with the addition effect, and 1-oxynaphthalene-8-sulphonamide is obtained. This may be coupled with a diazotized 1 : 2- or 2 : 1-aminonaphthol or a substitution product to obtain mordant dyestuffs which give blue to black shades on wool when after-chromed. In an example, 1-oxynaphthalene-8-sulphonamide is coupled with 1-diazo-2-oxynaphthalene-4-sulphonic acid or its nitrated derivative, and the product may be boiled with chromium formate, acetate, fluoride or hydroxide, or with a mixture of chromium oxide, caustic potash and glycerine. Particulars are also given of dyestuffs from chlor- or brom-1-diazo-2-oxynaphthalene-4-sulphonic acid, 2-amino-1-oxy-4-nitronaphthalene-7-sulphonic acid, and the 4-methylene-sulphonic-acid of 1-amino-2-naphthol.

207,174. ELECTROLYSIS. Siemens and Halske Akt.-Ges., Siemensstadt, near Berlin. International Convention date, November 15, 1922.

When using high current densities the electrolyte is kept in rapid motion near the electrode where the current enters. An annular vessel is formed of glass walls 13 and a platinum cone 11 and is immersed in the electrolyte. The vessel is



207,174

filled with mercury, into which dips a lead-in conductor 14. Electrolyte is injected by a nozzle 17 so that part of it passes through the cone 11 and part is deflected upwards past the electrode 18 to the liquid-sealed overflow 24. Gases are also carried downwards through the cone 11 and finally escape through the pipe 23. A gas outlet from the inner chamber is provided at 21. The apparatus may be used with a current density of 100 amperes per sq. cm. for the production of ozone and highly oxidised compounds.

LATEST NOTIFICATIONS.

209,706. Process for the preparation of diethylchloracetamide. Soc. Chimique des Usines du Rhone. January 10, 1923.
209,722. Manufacture of alkyl halides. J. P. Wibaut. January 12, 1923.
209,723. Manufacture of new azo dyestuffs. Soc. of Chemical Industry in Basle. January 9, 1923.
209,742. Process for the production of alloys poor in carbon and silicon. Aktiebolaget Ferrolegeringar. January 11, 1923.
209,757. Manufacture of zinc sulphide. Soc. Anon. Compagnie Generale des Produits Chimiques de Louvre. January 11, 1923.
209,767. Process for producing new organic compounds of mercury. Dr. A. Albert. January 12, 1923.
209,768. Process for producing new organic compounds of mercury. Dr. A. Albert. January 12, 1923.

Specifications Accepted, with Date of Application

190,115, 190,116, 209,169. Hydrogen sulphide and other impurities from gases and certain liquids, Process for removing. Koppers Co. December 8, 1921.
190,117, 190,119, 204,058, 209,378. Purifying gases, Process and apparatus for. Koppers Co. December 8, 1921, and October 3, 1922.
190,118. Hydrogen sulphide, Manufacture of. Koppers Co. December 8, 1921.
192,033. Sulphur, Method of and apparatus for burning. Texas Gulf Sulphur Co., Inc. January 21, 1922.
193,029. Mineral oils, Process for purifying. A. Rialland. February 7, 1922.
197,329. Cellulosic materials, Process for neutralising the hydrochloric acid formed by the chlorination of—with a view to obtaining cellulose. A. R. de Vains. May 3, 1922.
200,838. Electrodes for electrolytic cells. Electro Chemical Co. July 15, 1922.
201,885. Vulcanisation of rubber, Process for. Pirelli and Co. August 5, 1922.
208,685. Carbohydrate esters, Process of manufacturing. Soc. de Stearinerie et Savonnerie de Lyon. December 21, 1922.
208,832. Alkali sulphides from thiosulphates, Manufacture of. W. J. Mellersh-Jackson. (*Koppers Co.*) October 3, 1922.
209,124. Detinning of tinned iron scrap. N. Davies and M. A. Adam. July 5, 1922.
209,135. Disintegrating or emulsifying materials, Machines for. H. Povey. September 4, 1922.
209,148. Drying processes and apparatus. T. Rigby. September 30, 1922.
209,163. Disintegrators. Plauson's (Parent Co.), Ltd. (*H. Plauson.*) October 3, 1922.
209,270. Lithopone products and process of making the same. J. L. Mitchell. December 11, 1922.
209,312. Centrifugal separator. J. B. Arpin. February 5, 1923.
209,350. Arsenious sulphide sludges, Treatment of—for the separation of the sulphide from the associated liquid. L. A. Jordan. April 10, 1923.
209,355. Catalytic bodies, Preparation of. V. L. Oil Processes, Ltd., and O. D. Lucas. April 26, 1923.
209,169. Hydrogen sulphide from gases, Removal of. W. J. Mellersh-Jackson (*Koppers Co.*) October 3, 1922.
209,171. Hydrogen sulphide, Manufacture of. W. J. Mellersh-Jackson (*Koppers Co.*) October 3, 1922.

Applications for Patents

Albert, A. Process for producing organic compounds of mercury. 1,039, 1,043. January 14. (Germany, January 12, 1923.)
Donald, W. Drying peats, etc. 1,140. January 15.
Duckham, Sir A., Thermal Industrial and Chemical (T.I.C.) Research Co., Ltd., and Watts, J. S. Heat treatment of materials for distilling, drying, or carbonising them. 1,413. January 17.
Farbenfabriken vorm. F. Bayer and Co. Manufacture of nitric acid. 1,305. January 16. (Germany, February 26, 1923.)
Farbenfabriken vorm. F. Bayer and Co. Manufacture of lakes. 1,306. January 16. (Germany, May 22, 1923.)
Farbwerke vorm. Meister, Lucius, and Brüning, and Imray, O. Y. Manufacture of arsenic and antimony compounds. 1,314. January 16.
Farbwerke vorm. Meister, Lucius, and Brüning. Process for preparing azo dyestuffs. 1,505. January 18. (Germany, January 18, 1923.)
Fuchs, K. Fractional condensation of mineral oils, etc. 1,099. January 14. (Austria, January 13, 1923.)
Gray, S. J. Dehydration process. 1,497. January 18.
Kumst, E. Apparatus for chemically combining water with oil, fat, etc. 1,298. January 16.
Seth, R. H. von. Process for obtaining vanadium compounds or vanadium from pig iron. 1,189. January 15. (Sweden, February 9, 1923.)
Wefelscheid, P. Production of lead oxide. 1,276. January 16.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers ; those interested in close variations in prices should study the market report.*

LONDON, *January* 23, 1924.

BUSINESS has been severely affected by the railway strike, which has caused a decided set-back as against the improved tendency which we noticed last week. The demand in many directions has become purely nominal. Prices, however, are well maintained and movements generally are in an upward direction.

Export markets are fair.

General Chemicals

ACETONE is in good request, price unchanged.

ACID ACETIC has advanced in price. Market shows an upward tendency and the article is scarce in all early positions.

ACID CITRIC is unchanged.

ACID FORMIC.—Supplies have practically disappeared owing to the operation of the German Reparation Act. The spot price is nominal.

ACID LACTIC is unchanged.

ACID OXALIC is in fair demand. The improvement in price is maintained.

ACID TARTARIC is unchanged.

BARIUM CHLORIDE is unchanged.

FORMALDEHYDE is again slightly in buyers' favour, but stocks are light and an early improvement is expected.

LEAD ACETATE is in good inquiry and tends upwards.

LIME ACETATE is inquired for in all directions—little is available on the spot.

LITHOPONE is unchanged.

POTASSIUM CAUSTIC and CARBONATE are unchanged.

POTASSIUM PERMANGANATE is unchanged.

POTASSIUM PRUSSIATE is only in nominal demand and price tends to sag.

SODA ACETATE is very scarce and in active demand on both home trade and export account.

SODA NITRITE.—Price has remained nominal in view of the shortage.

SODA PRUSSIATE is unchanged.

Coal Tar Intermediates

Business is continued on quiet lines without any special change in prices.

ALPHA NAPHTHOL has been inquired for and the price is unchanged.

ALPHA NAPHTHYLAMINE continues on moderate lines.

ANILINE OIL has been in fair demand at recent quoted figures.

ANILINE SALT has been inquired for on export account.

BENZIDINE BASE is without special feature.

BETA NAPHTHOL has been inquired for on both home and export accounts.

DIMETHYLANILINE continues in fair request without much change in price.

DIPHENYLAMINE is quiet and firm.

NITRO BENZOL.—The usual home business has been passing.

PARANITRANILINE.—A fair inquiry is reported.

" R " SALT.—Maintains a slight improvement.

XYLIDINE is unchanged.

Pharmaceutical Chemicals

ACETYL SALICYLIC ACID continues very steady and in good demand.

ACID SALICYLIC is in better supply and is slightly easier.

BROMIDES.—An increased volume of business is reported, the general market situation being unchanged.

CALCIUM LACTATE.—Stocks are more plentiful and the price slightly lower.

CHLORAL HYDRATE is in buyers' favour.

EUCALYPTUS OIL.—The last prices are shaded in some directions.

GUAIACOL is easier, more liberal supplies being available than for some time past.

METHYL SALICYLATE.—Price is well maintained, supplies being on the short side.

MILK SUGAR tends to harden.

PHENOLPHTHALEIN.—Arrival of supplies, secured doubtless when lower prices were ruling, has led to lower prices being accepted. The general position and outlook, however, appear firm. Any revival of the demand should see higher prices.

RESORCINE MEDICINAL is much firmer and continental manufacturers have advanced their prices.

SODA SALICYLATE continues in good demand, price is unchanged. Continental manufacturers report that their production for early delivery is fully sold.

Coal Tar Products

Prices for Coal Tar Products show little change, and are as undernoted :—

90% BENZOL continues to be plentiful at 1s. 1d. to 1s. 1½d. per gallon on rails, for prompt delivery. Makers' ideas for forward business are somewhat higher, in view of the threatened rise in the price of petrol.

PURE BENZOL remains unchanged at 1s. 4½d. to 1s. 5½d. per gallon on rails.

CREOSOTE OIL is stationary in price, and has a slightly less demand. The value is from 8¾d. to 9d. per gallon in the North, while the price in the South is from 9¾d. to 10d. per gallon.

CRESYLIC ACID is fairly plentiful, and is quoted at 1s. 10d. per gallon for the Pale quality 97/99%, while the Dark quality 95/97% is 1s. 6d. to 1s. 8d. per gallon.

SOLVENT NAPHTHA is plentiful, and is quoted at 11d. to 1s. per gallon on rails.

HEAVY NAPHTHA can also be bought at about the above figures.

NAPHTHALENES are somewhat steadier, with a slightly improved demand for the better qualities. The low quality remains unchanged at £7 to £7 10s. per ton on rails, while 74/76 melting point is worth from £8 to £8 10s. per ton on rails, the 76/78 quality being worth from £9 to £9 10s. per ton.

PITCH.—No improvement has taken place, and orders remain scarce. To-day's values are 85s. to 90s. per ton, f.o.b., London, and 80s. to 85s. per ton, f.o.b., East and West coast.

Sulphate of Ammonia

Remains in satisfactory demand, and prices are unchanged.

Gas and Fuel Studies at Leeds

A FURTHER programme of special lectures, to be delivered during the second term of the session at Leeds University, has been arranged in connection with the Coal Gas and Fuel Industries Department. On the subject of the manufacture of coal gas, Mr. T. F. E. Rhead, chief chemist to the City of Birmingham Gas Department, will give six lectures on carbonisation practice, to be followed by six on gas purification practice. Mr. J. W. Wood, research chemist to the Joint Research Committee of the Institution of Gas Engineers and the University of Leeds, will deliver two lectures on the aeration of gas burners ; Professor J. W. Cobb will give a course of eight lectures on refractory materials, and other lectures will be four by Mr. H. S. Holdsworth, research assistant on the physical properties of refractory materials, and six by Mr. P. F. Summers on the microscopic study of engineering alloys. The laboratory of the department will be open on Wednesday evenings from January 23 to February 27 for a limited number of students who have already received some chemical training but who desire instruction in fuel calorimetry and pyrometry, and more advanced students, capable of independent work, may also be admitted to the laboratory during these periods.

Current Market Prices

General Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride, 90–95%	lb.	0	1	4	to	0	1	5
Acetone oil	ton	80	0	0	to	85	0	0
Acetone, pure	ton	125	0	0	to	126	0	0
Acid, Acetic, glacial, 99–100%	ton	73	0	0	to	74	0	0
Acetic, 80% pure	ton	51	0	0	to	52	0	0
Acetic, 40% pure	ton	26	0	0	to	27	0	0
Arsenic, liquid, 2000 s.g.	ton	85	0	0	to	88	0	0
Boric, commercial	ton	48	0	0	to	52	0	0
Carbolic, cryst. 39–40%	lb.	0	0	11½	to	0	1	0
Citric	lb.	0	1	5	to	0	1	5½
Formic, 85%	ton	64	0	0	to	65	0	0
Hydrofluoric	lb.	0	0	7½	to	0	0	8½
Lactic, 50 vol.	ton	39	0	0	to	40	0	0
Lactic, 60 vol.	ton	45	0	0	to	47	0	0
Nitric, 80 Tw.	ton	23	0	0	to	25	0	0
Oxalic	lb.	0	0	5¾	to	0	0	6
Phosphoric, 1.5	ton	35	0	0	to	38	0	0
Pyrogallic, cryst.	lb.	0	5	9	to	0	6	0
Salicylic, technical	lb.	0	1	9½	to	0	2	0
Sulphuric, 92–93%	ton	6	0	0	to	7	0	0
Tannic, commercial	lb.	0	2	3	to	0	2	9
Tartaric	lb.	0	1	0½	to	0	1	1
Alum, lump	ton	12	10	0	to	13	0	0
Chrome	ton	23	0	0	to	24	0	0
Alumino ferric	ton	7	0	0	to	7	5	0
Aluminium, sulphate, 14–15%	ton	8	10	0	to	9	0	0
Sulphate, 17–18%	ton	10	10	0	to	11	0	0
Ammonia, anhydrous	lb.	0	1	6	to	0	1	8
.880	ton	32	0	0	to	34	0	0
.920	ton	22	0	0	to	24	0	0
Carbonate	ton	30	0	0	to	32	0	0
Chloride	ton	50	0	0	to	55	0	0
Muriate (galvanisers)	ton	32	0	0	to	33	0	0
Nitrate (pure)	ton	40	0	0	to	45	0	0
Phosphate	ton	63	0	0	to	65	0	0
Sulphocyanide, commercial 90%	lb.	0	1	1	to	0	1	3
Amyl acetate, technical	ton	280	0	0	to	300	0	0
Arsenic, white powdered	ton	66	0	0	to	68	0	0
Barium, carbonate, Witherite	ton	5	0	0	to	6	0	0
Carbonate, Precip.	ton	15	0	0	to	16	0	0
Chlorate	ton	65	0	0	to	70	0	0
Chloride	ton	14	10	0	to	15	0	0
Nitrate	ton	33	0	0	to	35	0	0
Sulphate, blanc fixe, dry	ton	20	10	0	to	21	0	0
Sulphate, blanc fixe, pulp	ton	10	5	0	to	10	10	0
Sulphocyanide, 95%	lb.	0	0	11	to	0	1	0
Bleaching powder, 35–37%	ton	10	0	0	to	10	10	0
Borax crystals, commercial	ton	25	0	0	to		—	
Calcium acetate, Brown	ton	13	0	0	to	14	0	0
Grey	ton	22	0	0	to	23	0	0
Carbide	ton	13	0	0	to	13	10	0
Chloride	ton	5	15	0	to	6	0	0
Carbon bisulphide	ton	35	0	0	to	40	0	0
Casein technical	ton	80	0	0	to	90	0	0
Cerium oxalate	lb.	0	3	0	to	0	3	6
Chromium acetate	lb.	0	1	1	to	0	1	3
Cobalt acetate	lb	0	6	0	to	0	6	6
Oxide, black	lb.	0	9	6	to	0	10	0
Copper chloride	lb.	0	1	1	to	0	1	2
Sulphate	ton	25	0	0	to	25	10	0
Cream Tartar, 98–100%	ton	86	0	0	to	88	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde, 40% vol.	ton	63	0	0	to	64	0	0
Formusol (Rongalite)	lb.	0	1	11	to	0	2	0
Glauber salts, commercial	ton	4	0	0	to	4	10	0
Glycerin crude	ton	65	0	0	to	67	10	0
Hydrogen peroxide, 12 vols.	gal	0	2	0	to	0	2	1
Iron perchloride	ton	18	0	0	to	20	0	0
Sulphate (Copperas)	ton	3	10	0	to	4	0	0
Lead acetate, white	ton	44	0	0	to	46	0	0
Carbonate (White Lead)	ton	50	0	0	to	52	0	0
Nitrate	ton	44	10	0	to	45	0	0
Litharge	ton	37	0	0	to	39	0	0
Lithophone, 30%	ton	22	10	0	to	23	0	0
Magnesium chloride	ton	3	10	0	to	3	15	0
Carbonate, light	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial)	ton	5	15	0	to	6	0	0
Sulphate (Druggists')	ton	8	0	0	to	9	0	0
Manganese Borate, commercial	ton	65	0	0	to	75	0	0
Sulphate	ton	45	0	0	to	50	0	0
Methyl acetone	ton	82	0	0	to	85	0	0
Alcohol, 1% acetone	ton	80	0	0	to	85	0	0
Nickel sulphate, single salt	ton	37	0	0	to	38	0	0
Ammonium sulphate, double salt	ton	37	0	0	to	38	0	0
Potash, Caustic	ton	33	0	0	to	34	0	0
Potassium bichromate	lb.	0	0	5¾	to		—	
Carbonate, 90%	ton	30	0	0	to	31	0	0
Chloride, 80%	ton	9	0	0	to	10	0	0
Chlorate	lb.	0	0	3¼	to		—	
Metabisulphite, 50–52%	ton	65	0	0	to	70	0	0
Nitrate, refined	ton	38	0	0	to	40	0	0
Permanganate	lb.	0	0	10½	to	0	0	10¾
Prussiate, red	lb.	0	2	8	to	0	2	10
Prussiate, yellow	lb.	0	0	9½	to	0	0	10
Sulphate, 90%	ton	10	0	0	to	10	10	0
Salammoniac, firsts	cwt.	2	15	0	to		—	
Seconds	cwt.	2	17	6	to		—	
Sodium acetate	ton	25	0	0	to	25	10	0
Arsenate, 45%	ton	45	0	0	to	48	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	4¼	to		—	
Bisulphite, 60–62%	ton	21	0	0	to	23	0	0
Chlorate	lb.	0	0	2¾	to	0	0	3
Caustic, 70%	ton	17	10	0	to	18	0	0
Caustic, 76%	ton	18	10	0	to	19	0	0
Hydrosulphite, powder	lb.	0	1	5	to	0	1	6
Hyposulphite, commercial	ton	10	10	0	to	11	0	0
Nitrite, 96–98%	ton	31	0	0	to	32	0	0
Phosphate, crystal	ton	16	0	0	to	16	10	0
Perborate	lb.	0	0	11	to	0	1	0
Prussiate	lb.	0	0	6	to		—	
Sulphide, crystals	ton	8	10	0	to	9	0	0
Sulphide, solid, 60–62%	ton	15	0	0	to	16	10	0
Sulphite, cryst.	ton	11	10	0	to	12	0	0
Strontium carbonate	ton	50	0	0	to	55	0	0
Nitrate	ton	50	0	0	to	55	0	0
Sulphate, white	ton	6	10	0	to	7	10	0
Sulphur chloride	ton	25	0	0	to	27	10	0
Flowers	ton	11	0	0	to	11	10	0
Roll	ton	9	15	0	to	10	10	0
Tartar emetic	lb.	0	0	11½	to	0	1	0
Tin perchloride, 33%	lb.	0	1	1	to	0	1	2
Perchloride, solid	lb.	0	1	3	to	0	1	4
Protochloride (tin crystals)	lb.	0	1	4	to	0	1	5
Zinc chloride 102° Tw.	ton	20	0	0	to	21	0	0
Chloride, solid, 96–98%	ton	25	0	0	to	30	0	0
Oxide, 99%	ton	42	0	0	to	45	0	0
Dust, 90%	ton	50	0	0	to	55	0	0
Sulphate	ton	15	0	0	to	16	0	0

Pharmaceutical Chemicals

	Per	£	s.	d.		£	s.	d.
Acetyl salicylic acid	lb.	0	3	9	to	0	4	0
Acetanilid	lb.	0	3	3	to	0	3	6
Acid, Gallic, pure	lb	0	3	0	to	0	3	3
Lactic, 1.21	lb.	0	2	10	to	0	3	3
Salicylic, B.P.	lb.	0	2	5	to	0	2	7
Tannic, leviss.	lb.	0	3	2	to	0	3	4
Amidol	lb.	0	7	6	to	0	8	0
Amidopyrin	lb.	0	14	0	to	0	14	6
Ammon ichthosulphonate	lb	0	1	10	to	0	2	0
Barbitone	lb.	0	17	0	to	0	17	6
Beta naphthol resublimed	lb	0	3	0	to	0	3	6
Bromide of ammonia	lb.	0	0	10½	to	0	1	0
Potash	lb.	0	0	8½	to	0	0	9
Soda	lb.	0	0	9½	to	0	0	10½
Caffeine, pure	lb	0	12	3	to	0	12	9
Calcium glycerophosphate	lb.	0	5	9	to	0	6	0
Lactate	lb	0	2	0	to	0	2	3
Calomel	lb.	0	3	9	to	0	4	0
Chloral hydrate	lb.	0	4	1½	to	0	4	3
Cocaine alkaloid	oz	1	0	0	to	1	1	0
Hydrochloride	oz	0	17	0	to	0	17	6
Corrosive sublimate	lb.	0	3	3	to	0	3	6
Eucalyptus oil, B.P. (70–75% eucalyptol)	lb.	0	2	4	to	0	2	6
B.P. (75–80% eucalyptol)	lb.	0	2	5	to	0	2	7
Guaiacol carbonate	lb.	0	13	3	to	0	13	6
Liquid	lb.	0	11	6	to	0	12	0
Pure crystals	lb.	0	12	6	to	0	13	0
Hexamine	lb.	0	4	3	to	0	4	6
Hydroquinone	lb.	0	4	3	to	0	4	6
Lanoline anhydrous	lb.	0	0	7	to	0	0	6
Lecithin ex ovo	lb.	1	5	0	to	1	7	6
Lithi carbonate	lb.	0	10	0	to	0	10	6
Methyl salicylate	lb.	0	3	0	to	0	3	6
Metol	lb.	0	9	0	to	0	10	0
Milk sugar	cwt	4	0	0	to	4	5	0
Paraldehyde	lb.	0	1	7	to	0	1	9
Phenacetin	lb.	0	7	6	to	0	8	0
Phenazone	lb.	0	8	3	to	0	8	6
Phenolphthalein	lb.	0	8	0	to	0	8	3
Potassium sulpho guaiacolate	lb.	0	7	3	to	0	7	9
Quinine sulphate, B.P.	oz.	0	2	3	to		—	

	Per	£	s.	d.		£	s.	d.
Resorcin, medicinal	lb.	0	6	3	to	0	6	6
Salicylate of soda powder	lb.	0	3	0	to	0	3	3
Crystals	lb.	0	3	0	to	0	3	3
Salol	lb.	0	4	0	to	0	4	3
Soda Benzoate	lb.	0	3	6	to	0	3	9
Sulphonal	lb.	0	17	0	to	0	18	0
Terpene hydrate	lb.	0	1	9	to	0	2	0
Theobromine, pure	lb.	0	12	0	to	0	12	3
Soda salicylate...	lb	0	8	6	to	0	9	0
Vanillin	lb.	1	4	0	to	1	5	0

Coal Tar Intermediates, &c.

Alphanaphthol, crude	lb.	0	1	9	to	0	2	0
Refined	lb.	0	2	3	to	0	2	6
Alphanaphthylamine	lb.	0	1	6½	to	0	1	7
Aniline oil, drums extra	lb.	0	0	8½	to	0	0	8¾
Salts	lb.	0	0	9	to	0	0	9¼
Anthracene, 40–50%	unit	0	0	8½	to	0	0	9
Benzaldehyde (free of chlorine)	lb.	0	2	9	to	0	3	0
Benzidine, base	lb.	0	4	6	to	0	4	9
Sulphate	lb.	0	3	6	to	0	3	9
Benzoic acid	lb.	0	2	0	to	0	2	3
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol	lb.	0	1	1	to	0	1	2
Betanaphthylamine, technical	lb.	0	4	0	to	0	4	3
Croceine Acid, 100% basis	lb.	0	3	3	to	0	3	6
Dichlorbenzol	lb	0	0	9	to	0	0	10
Diethylaniline	lb.	0	4	6	to	0	4	9
Dinitrobenzol	lb.	0	1	1	to	0	1	2
Dinitrochlorbenzol	lb.	0	0	11	to	0	1	0
Dinitronaphthalene	lb.	0	1	4	to	0	1	5
Dinitrotoluol	lb.	0	1	3	to	0	1	4
Dinitrophenol	lb.	0	1	6	to	0	1	7
Dimethylaniline	lb	0	2	8	to	0	2	10
Diphenylamine	lb.	0	3	3	to	0	3	6
H-Acid	lb.	0	4	6	to	0	4	9
Metaphenylenediamine	lb.	0	4	0	to	0	4	3
Monochlorbenzol	lb	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	5	9	to	0	6	0
Metatoluylenediamine	lb.	0	4	0	to	0	4	3
Monosulphonic Acid (2.7)	lb.	0	8	6	to	0	9	6
Naphthionic acid, crude	lb.	0	2	4	to	0	2	6
Naphthionate of Soda	lb	0	2	4	to	0	2	6
Naphthylamine-di-sulphonic-acid	lb.	0	4	0	to	0	4	3
Neville Winther Acid	lb	0	7	3	to	0	7	9
Nitrobenzol	lb.	0	0	7	to	0	0	8
Nitronaphthalene	lb.	0	0	11½	to	0	1	0
Nitrotoluol	lb.	0	0	8	to	0	0	9
Orthoamidophenol base	lb.	0	12	0	to	0	12	6
Orthodichlorbenzol	lb.	0	1	0	to	0	1	1
Orthotoluidine	lb.	0	0	10	to	0	0	11
Orthonitrotoluol	lb.	0	0	3	to	0	0	4
Para-amidophenol, base	lb.	0	8	6	to	0	9	0
Hydrochlor	lb	0	7	6	to	0	8	0
Paradichlorbenzol	lb.	0	0	9	to	0	0	10
Paranitraniline	lb.	0	2	7	to	0	2	9
Paranitrophenol	lb.	0	2	3	to	0	2	6
Paranitrotoluol	lb.	0	2	9	to	0	3	0
Paraphenylenediamine, distilled	lb.	0	12	0	to	0	12	6
Paratoluidine	lb.	0	5	6	to	0	5	9
Phthalic anhydride	lb.	0	2	6	to	0	2	9
Resorcin technical	lb.	0	4	0	to	0	4	3
Sulphanilic acid, crude	lb.	0	0	9	to	0	0	10
Tolidine, base	lb.	0	7	3	to	0	7	9
Mixture	lb.	0	2	6	to	0	2	9

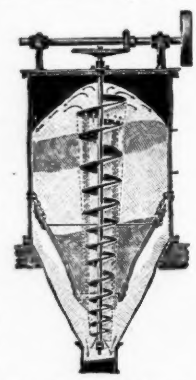
Essential Oils and Synthetics

Essential Oils.		£	s.	d
Anise	c.i.f. 1/9 spot	0	1	10
Bay		0	12	0
Bergamot	dearer	0	14	3
Cajaput		0	3	3
Camphor, white	per cwt.	4	0	0
Brown	,,	3	15	0
Cassia	c.i.f. 5/6 spot	0	8	0
Cedarwood		0	1	6
Citronella (Ceylon)	easier c.i.f. 3/6 spot	0	3	10
(Java)	firm c.i.f. 4/4 spot	0	4	7
Clove		0	9	6
Eucalyptus		0	2	4
Geranium Bourbon		1	16	0
Lavender		1	6	0
Lavender Spike	dearer	0	4	3
Lemon		0	3	0
Lemongrass	dearer per oz.	0	0	2¼
Lime (distilled)	firm	0	4	3
Orange sweet (Sicilian)	,,	0	11	6
(West Indian)	,,	0	9	6
Palmarosa		0	18	0
Peppermint (American)		0	16	0
Mint (dementholised Japanese)	dearer	0	14	0
Patchouli		1	5	0
Otto of Rose	per oz.	1	15	0
Rosemary		0	1	11
Sandalwood		1	5	0
Sassafras		0	9	9
Thyme	2/6 to	0	8	0

Synthetics.			£	s.	d.
Benzyl acetate		per lb.	0	3	3
Benzoate		,,	0	3	6
Citral		,,	0	10	0
Coumarine		,,	1	0	0
Heliotropine		,,	0	8	0
Ionone		,,	1	5	0
Linalyl acetate		,,	1	2	6
Methyl salicylate	slightly easier	,,	0	3	0
Musk xylol		,,	0	18	0
Terpeniol		,,	0	2	9

A Well-Designed Mixer

Means of efficiently mixing powdery materials are required occasionally in the chemical industry, and particularly in handling fertilisers. An interesting device known as the "Geyser" mixer, manufactured by A. R. Tattersall and Co., 75, Mark Lane, London, E.C.3, has recently been brought to our notice. This consists essentially of a conical vessel, with the widest part uppermost, in which a *slightly conical* worm rotates. The materials are fed at the top and removed from the base as required. The action of the worm is important, as it raises and mixes the powders perfectly with a very low absorption of power, owing to its conical form. Being wider at the top, the worm allows more material to be lifted at the upper end, so that the whole action is one of lifting, thus preventing packing or clogging of the substance at the bottom of the vessel. In construction the appliance is solid, and the body is fitted with a glass window through which it is possible to view the process. The whole of the weight of the conveyor is taken on a ball thrust bearing at the top. The power required to operate the 1-ton size is only 2 h.p. The machine is available in various sizes ranging from 5 cwt. to 2 tons per charge.



The Geyser Mixer.

Centrifugal Clutches for Electric Motors

In all electrically equipped factories there is a need for clutch couplings to the electric motors in order that they may take the load at starting. An excellent catalogue has just been issued by Thomas Broadbent and Sons, Ltd., at Huddersfield, in which their special centrifugal clutches are illustrated and described. These clutches are of extremely sound design, the "driving" member carrying a number of shoes with "Ferodo" linings on their outer edges. When the speed of revolution reaches a predetermined figure, these shoes move outwards against their retaining springs under centrifugal force, and engage with the driven portion of the clutch, which is in the form of a ring. The motor thus automatically takes up the load when its speed is sufficient to carry it, and is relieved of considerable starting torque. In this way alternating current motors of the squirrel-cage type may be advantageously employed in cases where their poor starting torque would otherwise render them unsuitable. The clutch can also be arranged to slip with a given overload. The catalogue describes clutches for various types of drive. They are, of course, available in various sizes for transmitting powers from ¼ h.p. to 250 h.p., and are also suitable for gas and oil engines.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.*

Glasgow, January 24, 1924.

THERE was a considerable improvement in the number of orders booked during the past week, due, no doubt, to the threatened railway strike, which has just started. In this district the railway companies have refused to accept any traffic, and locally business must therefore be very restricted until the strike ends.

Prices are on about a level with those reported last week.

Industrial Chemicals

ACID ACETIC.—Glacial, 98/100%, £60 to £67 per ton; 80% pure, £49 to £51 per ton; 80% technical, £47 to £48 per ton, all packed in casks, delivered c.i.f. U.K. ports, duty free.

ACID BORACIC.—Crystals or granulated, £48 per ton; powdered, £50 per ton, carriage paid U.K. stations, minimum ton lots.

ACID CARBOLIC, ICE CRYSTALS.—Still further reduction. Now offered at 10d. per lb., carriage paid.

ACID CITRIC, B.P. CRYSTALS.—Unchanged at about 1s. 4¼d. per lb., less 5% ex store.

ACID FORMIC, 85%.—Moderate inquiry. Spot material inclined to be higher at about £63 per ton, ex store.

ACID HYDROCHLORIC.—In little demand. Price 6s. 6d. per carboy, ex works.

ACID NITRIC, 80°.—£23 10s. per ton, ex station, full truck loads.

ACID OXALIC.—Nominally 5¾d. per lb., ex store, but in little demand, and could probably be obtained for less.

ACID SULPHURIC.—144, °£3 12s. 6d. per ton; 168°, £7 per ton, ex works, full truck loads. Dearsenicated quality, 20s. per ton more.

ACID TARTARIC, B.P. CRYSTALS.—Unchanged at about 1s. per lb., less 5% ex wharf.

ALUMINA, SULPHATE, 17/18%, Iron Free.—Spot lots quoted £8 10s. per ton, ex store. Offered for forward delivery at about £7 10s. per ton, c.i.f. U.K. port.

ALUM, CHROME.—Price unchanged at £26 to £28 per ton, according to quality, delivered f.o.b. U.K. port.

ALUM, POTASH (LUMP).—Quoted £10 17s. 6d. per ton, f.o.b. U.K. port for export. Continental material on offer at about the same price, ex store.

AMMONIA, ANHYDROUS.—Unchanged at about 1s. 5d. per lb., ex station, prompt delivery.

AMMONIA CARBONATE.—Lump, £35 per ton; powdered, £37 per ton, packed in casks, carriage paid U.K. station.

AMMONIA LIQUID, 880°.—Unchanged at 3d. per lb., delivered, containers extra.

AMMONIA MURIATE.—Grey galvanisers' quality offered at £31 to £32 per ton, ex station, spot delivery. Fine white crystals quoted £27 15s. per ton, ex store.

ARSENIC, WHITE POWDERED.—Spot lots quoted £73 to £74 per ton, ex store. Offered for export at £70 per ton, f.o.b. U.K. port.

BARIUM CHLORIDE, 98/100%.—In little demand. English material unchanged at about £15 per ton, ex store.

BARYTES.—Finest white English unchanged at £5 5s. per ton, ex works. Good quality continental material offered at £5 per ton, c.i.f. U.K. ports.

BLEACHING POWDER.—Spot lots £11 per ton, ex station. Contracts 20s. per ton less.

BORAX.—Granulated, £24 10s. per ton; crystal, £25 per ton; powdered, £26 per ton, carriage paid U.K. stations, minimum ton lots.

CALCIUM CHLORIDE.—English material unchanged at £5 12s. 6d. per ton, ex station. Offered from the continent at about £4 15s. per ton, c.i.f. U.K. ports.

COPPERAS, GREEN.—Price about £2 5s. per ton, f.o.b. U.K. port in bulk; packed in casks about £4 per ton, f.o.b.

COPPER SULPHATE.—Price unchanged at about £25 per ton, less 5%, f.o.b. U.K. port.

FORMALDEHYDE, 40%.—Quoted £63 per ton, ex store, spot delivery. In little demand.

GLAUBER SALTS.—English material, £4 per ton, ex store or station. Continental offering at about £3 5s. per ton, c.i.f. U.K. port.

LEAD, RED.—English makers' price nominally £46 10s. per ton, carriage paid U.K. station, but parcels can be obtained at considerably less. Continental now offered at about £37 10s. per ton, c.i.f. U.K. port. Spot lots quoted £38 per ton, ex store.

LEAD, WHITE.—Continental material on offer at about £41 per ton, ex store.

LEAD ACETATE.—Spot material on offer at about £47 per ton, ex store. Offered from the continent at £46 15s. per ton, c.i.f. U.K. port.

MAGNESITE CALCINED.—Finest English material offered at £8 per ton, ex station.

MAGNESIUM CHLORIDE.—Spot material still available at about £4 per ton, ex store. Offered from the continent at about £3 10s. per ton, c.i.f. U.K. port, prompt shipment.

MAGNESIUM SULPHATE (EPSOM SALTS).—Commercial quality, offered at about £5 per ton, ex store. B.P. quality, £6 5s. per ton, ex station, prompt delivery.

POTASH, CAUSTIC, 88/92%.—Spot material inclined to be scarce; quoted £34 per ton, ex store. Offered from the continent at about £30 per ton, c.i.f. U.K. port.

POTASSIUM BICHROMATE.—Unchanged at 5¾d. per lb., delivered.

POTASSIUM CARBONATE, 96/98%.—Quoted £29 per ton, ex store, spot delivery. Continental offers now advanced to £28 5s. per ton, c.i.f. U.K. port.

POTASSIUM CHLORATE.—Little inquiry. Spot lots unchanged at about 3½d. per lb., ex store.

POTASSIUM NITRATE (SALTPETRE).—Quoted £32 10s. per ton, ex store, spot delivery. Offered for forward delivery from the continent at about £24 5s. per ton, c.i.f. U.K. port.

POTASSIUM PERMANGANATE, B.P. CRYSTALS.—Quoted 10½d. per lb., ex store, spot delivery. In little demand.

POTASSIUM PRUSSIATE (YELLOW).—Quoted 9½d. per lb., f.o.b. U.K. port for export. Spot material on offer at 9¾d. per lb., ex station.

SODA CAUSTIC.—76/77%, £19 7s. 6d. per ton; 70/72%, £17 17s. 6d. per ton; 60/62% broken, £19 2s. 6d. per ton; 98/99% powdered, £22 15s. per ton. All ex station, spot delivery. Contracts 20s. per ton less.

SODIUM ACETATE.—Little spot material available, but offered for early delivery at about £23 per ton, ex wharf.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay or station. M.W. quality, 30s. per ton less.

SODIUM CARBONATE.—Soda Crystals, £5 to £5 5s. per ton, ex quay or station. Alkali 58%, £8 12s. 3d. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—English makers' price about £10 per ton, ex station. Continental obtainable at about the same figure. Pea crystals quoted £15 per ton, ex store.

SODIUM NITRATE, 100%.—Quoted £26 10s. to £28 10s. per ton according to quantity, f.o.b. U.K. port.

SODIUM PRUSSIATE (YELLOW).—Unchanged at about 5d. per lb., f.o.b. U.K. port for export. Spot material available at about 5¼d. per lb., ex store.

SODIUM SULPHATE (SALTCAKE).—Price for home consumption, £4 5s. per ton, carriage paid stations. Good export inquiry.

SODIUM SULPHIDE.—60/62% solid, £15 per ton, ex station; broken, £1 per ton more; 31/34% crystals, £9 7s. 6d. per ton, ex station.

SULPHUR.—Flowers, £10 per ton; roll, £9 per ton; rock, £9 per ton; ground, £8 per ton. Prices nominal.

TIN, CRYSTALS.—Quoted 1s. 3½d. per lb., f.o.b. U.K. port.

ZINC CHLORIDE, 98/100%.—Unchanged at about £25 per ton, f.o.b. U.K. port.

NOTE.—The above prices are for bulk business, and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ALPHA NAPHTHYLAMINE.—Good demand. Export price 1s. 5d. per lb., f.o.b.

ANILINE OIL.—Manufacturers' price, 8½d. lb., delivered, returnable drums.

ANILINE SALT.—8½d. per lb., casks included.
BENZIDINE BASE.—Good export inquiry. Price 4s. 6d. lb., 100% basis, f.o.b.
ACETANILIDE.—Small home inquiry. Price 1s. 8d. lb., delivered.
DIMETHYLANILINE.—Good home inquiry. Price 2s. 5d. lb., delivered.
META PHENYLENE DIAMINE.—Small export inquiry. Price 4s. 6d. lb., f.o.b.
ORTHO TOLUIDINE.—Some export inquiry. Price 11d. lb., drums included, f.o.b.
PARANITRANILINE.—Demand good. Price 2s. 5d. lb., delivered.
TOLIDINE BASE.—Some export inquiries. Price 6s. 11d. lb., 100% basis, f.o.b.

The Manchester Chemical Market

(FROM OUR OWN CORRESPONDENT.)

Manchester, January 24, 1924.

BUSINESS on the chemical market here this week has been only on moderate lines. The railway trouble is, of course, not without its influence, but a more direct factor has been the question of prices. In some lines these have shown a weakening tendency and the effect has been to some extent to discourage purchases for delivery very far ahead, buyers contenting themselves with placing orders for prompt or near delivery. While this tendency has been by no means general it has naturally had its effect on the total amount of business done.

Heavy Chemicals

Hyposulphite of soda is unchanged from last week at £15 per ton for photographic crystals and round £10 per ton for commercial quality; no improvement in buying interest can, however, be reported. Bichromate of soda is steady and in moderate inquiry at 4½d. per lb. Prussiate of soda is still offering at 5½d. per lb., though business is only on a small scale. Nitrite of soda continues scarce and firm at £28 10s. per ton. Soda crystals are in fair demand with values steady at £5 5s. per ton. Sodium sulphide keeps quiet, with concentrated, 60–65 per cent., quoted at £14 10s. to £15 per ton and crystals at £9. Phosphate of soda is also inactive and values are rather easier at £14 per ton. Saltcake is fairly active both on home and foreign account, and prices are unchanged at £4 10s. per ton. Caustic soda is quoted at from £16 17s. 6d. per ton for 60 per cent. material to £19 7s. 6d. for 76–77 per cent. Bleaching powder is quieter at £10 per ton in casks. Alkali meets with a quietly steady demand at about £7 per ton for 58 per cent. quality. Bicarbonate of soda is in fair inquiry and prices are unchanged at £10 10s. per ton. Glauber salts are steady but inactive at £3 10s. per ton. Chlorate of soda is easy at 2¾d. per lb., and business is not of big dimensions. The demand for acetate of soda is quiet but prices are maintained at last week's level of £23 per ton.

Both caustic potash and carbonate of potash are firmly held, the former at about £32 per ton for 90 per cent. strength and carbonate at round £28 per ton for 88–92 per cent. material. Bichromate of potash is steady and in moderate inquiry at 5¾d. per lb. Yellow prussiate of potash is still quiet but values show no further change at 8½d. per lb. Permanganate of potash is featureless, prices ranging from 8½d. to 9d. per lb. according to quality. Chlorate of potash is quiet but fairly steady at about 3d. per lb.

No improvement in the demand for arsenic can be reported and values are slightly easier at £67 per ton for white powdered, Cornish makes. Sulphate of copper is said to be rather more active although prices are unchanged at £25 10s. per ton, f.o.b. Acetate of lead is firmer at £45 to £46 per ton for white and about 20s. more for brown, supplies being taken up in steady quantities. Acetate of lime is steady at £21 to £22 for grey and about £14 10s. per ton for brown. Nitrate of lead is about unchanged at £42 to £43 per ton. Commercial Epsom salts are offering at £4 10s. per ton, with magnesium sulphate, B.P., steady at £6 5s.

Acids and Tar Products

Tartaric acid is a shade more active at 1s. 1½d. per lb. Citric acid continues quiet but steady at 1s. 4½d. per lb. Acetic acid is firmer and in steady demand at £47 per ton for 80 per cent. commercial and about £65 for glacial. Oxalic acid keeps very quiet at 5½d. per lb.

The position of coal-tar products is much the same as at last report, the demand being slow in most sections. Carbolic acid is still quiet, with supplies on the short side; crude is at 2s. 2d. to 2s. 4d. and crystals at about 10d. per lb. Creosote is in quietly steady demand at 9d. to 9½d. per gallon. Naphthalenes are dull but about unchanged from last week at £18 per ton for refined and £6 to £10 for crude. Solvent naphtha is quiet and easy at 1s. 1d. per gallon.

Duty-Free Import of Dyes to Italy

THE Italo-Swiss Commercial Treaty of January 27, 1923, provides for the duty-free admission into Italy of vat and gallocyanine dyes of Swiss origin. In virtue of the most-favoured-nation provisions of the Anglo-Italian Treaty of Commerce and Navigation of 1883, similar dyes of United Kingdom origin are equally entitled to duty-free admission, and arrangements have been made with the Italian Government to secure such duty-free admission, under conditions similar to those governing the duty-free importation of the dyes from Switzerland. In order to benefit by the duty-free admission, such dyes must be accompanied by a certificate attesting that the dyes are in fact of the type claimed, issued by the Association of British Chemical Manufacturers (166, Piccadilly; London, W.1) and signed by Mr. W. J. U. Woolcock, C.B.E., the General Manager of the Association. Intending exporters of vat and gallocyanine dyes of United Kingdom origin should therefore apply to the above Association for the necessary certificates if they desire to secure duty-free admission for their products on importation into Italy.

Proposed Aluminium Plant for Fort-William

UNDER the auspices of the West Highland Museum an interesting lecture on "Aluminium" was delivered before a large audience in the Town Hall, Fort-William, by Mr. C. B. Brook, F.I.C., chief chemist to the British Aluminium Co. Dr. Brook's description of the history and development of the manufacture of aluminium, illustrated by lantern slides and chemical experiments, appealed with special significance to his hearers, in view of the local interest aroused by the prospect of the establishment of works for its production in Fort-William. It was stated that the negotiations for the development of the Lochaber water power scheme were proceeding in a very encouraging manner, and it was hoped that they would shortly be brought to a satisfactory conclusion. With an improvement in general trade conditions there was every prospect of an early start being made.

German Free Import List Extended

A FRESH extension of the list of articles which may be imported into Germany without an import licence has been made, which includes turpentine resins, camphor, polishing lime, etc., iron oxide, gypsum, gypsum superphosphate, bauxite (unpurified), cryolite, residues such as coke from oil or tar distillation, lubricating and other mineral oils, coal tar, coal tar pitch, benzol, naphthalene, aniline and other coal tar products. The list also includes mercury and its amalgams, alkaline and certain other metals, natural salts, citrate of lime, crude or half refined tartar, dyewood extracts, wood tar oil, casein, and its preparations if not suitable for use as food, quinine and its salts, and many other items. The full list may be obtained from the Board of Trade and appeared in the *Journal* of January 17.

Standard Determination of Viscosity

THE determination of viscosity is carried out practically in different forms of apparatus and usually expressed in terms of that apparatus, with the result that determinations by different methods are frequently not comparable. The British Engineering Standards Association, of 28, Victoria Street, London, have just issued a publication entitled "The Determination of Viscosity in Absolute Units" (priced at 1s.), which gives full details of accurate and commercially applicable methods for determining viscosity in C.G.S. units. The specifications include standard dimensions for U-tube, co-axial bulb, and falling sphere viscomiters and the standard liquids used for calibrating them.

Company News

INTERNATIONAL NICKEL CO.—A quarterly dividend of 1½ per cent. on the preferred stock is announced, payable on February 1 to holders registered on January 17.

SOUTH METROPOLITAN GAS CO.—The ordinary general meeting will be held at the Cannon Street Hotel, on February 13, at two o'clock. The transfer books will be closed on and from January 30 until after the meeting.

RHODESIAN KING ASBESTOS CO., LTD.—An extraordinary general meeting is to be held on January 28, to consider an agreement under which all the company's mining claims and property is to be sold to the Rhodesian and General Asbestos Corporation, Ltd., for 79,516 fully paid £1 shares of that company.

CONFEDERATION LIFE ASSOCIATION.—Cabled advice from the Head Office, Toronto, states that new business for 1923 totalled £6,211,000, an increase of £1,061,000. Assets at £7,616,000 show an advance of £727,000, and the surplus earned of £248,300 is £33,000 higher. Surplus in hand amounts to £820,000, an increase of £113,000.

GAS LIGHT AND COKE CO.—The directors recommend a final dividend of £2 13s. 4d. per cent. on the ordinary stock, making £5 5s. 4d. per cent. for the past year, and carrying forward £227,295. The ordinary Stock received £5 4s. per cent. for 1922, £4 13s. 4d. for 1921, and £3 per cent. for each of the three preceding years. Twelve months ago £244,355 was carried forward.

BLUNDELL, SPENCE AND CO.—In their annual report the directors recommend a dividend at the rate of 8 per cent. per annum on the ordinary shares, payable in two equal instalments on February 26 and August 26. There will remain a sum of £15,024 to be carried forward. The dubious and bad debt account has £13,840 standing to its credit. The gratuity fund will amount to £1,338, and the investments of the Longstaff pension fund to £16,328. During the past year £16,845 has been spent on maintenance repairs, etc., of which £15,645 has been charged to revenue.

MAGADI SODA CO., LTD.—According to a circular issued to the shareholders, an extraordinary general meeting of the company will be held in London on January 28, when a resolution will be submitted for winding up the concern and appointing Mr. A. W. Tait, of Basildon House, Moorgate, as liquidator. It is proposed to form a new company, with a capital of £1,025,000, divided into 400,000 7 per cent. preference shares of £1 each and 2,500,000 ordinary shares of 5s each. It will create first debentures to the extent of £499,950, carrying interest at £6 per cent. Provision will be made for payment in full of certain creditors of the old company. The first directors of the new company will be Lord Southborough, the Hon. W. H. Samuel, Mr. A. Chester Beatty, Mr. A. W. Tait, and Mr. W. Selkirk.

BENZOL AND BY-PRODUCTS, LTD.—The report of the directors for the eighteen months from April 1, 1922, to September 30, 1923, states that the net profit for the period is £47,934 (against a loss for the preceding twelve months of £44,493), arrived at after deduction of depreciation, management commission, and all other charges, setting aside £8,000 in respect of income tax reserve, and deducting £1,965 balance of loss not written off. From this net profit the preference dividend at the rate of 6 per cent. per annum to September 30, 1923, has been paid, absorbing (including tax) £7,921, leaving a balance of £40,013, which has been carried forward. The directors are satisfied that ample provision for depreciation has been made. The report further states that while the company has no bank overdraft or other charges upon its undertaking, the present liquid position is the strongest in the company's trading history.

Tariff Changes

GERMANY.—Considerable additions have been made to the import free list, as detailed on page 106.

ITALY.—Vat and gallocyanine dyes may now be imported duty-free under certain conditions, shown on page 106.

Westminster Bank

Chairman's Advice to British Investors

THE annual ordinary general meeting of the shareholders of the above Bank was held at the Head Office, 41, Lothbury, London, E.C., on Thursday. Mr. Walter Leaf (the chairman) presided.

The Chairman, after a review of general conditions during the year under review, as revealed by import and export figures, observed that though the effect of a revival of trade had shown itself rather tardily, yet the evidence of the last quarter of the year was fairly unanimous in speaking of better conditions and hopeful prospects. Not, of course, that the prospect was uniformly rosy. There were several very important industries in which unfortunately it could not be said that the corner had been turned. But in the majority of the bank's reports from all over the country they heard, in one form or another, that the outlook was considered good, and that the new year was opening with confidence and hope. Following upon a review of the leading industries of the country, he alluded to the Fordney Tariff, pointing out that the balance of trade as between this country and America in the first nine months of 1923 compared with the first nine months of 1922, had moved nearly £27,000,000 in favour of this country.

The Political Situation

Commenting upon the political situation, he said it was piquant and interesting; but for the business man not wholly unsatisfactory. Business wanted to be let alone; we had enough of Government interference during the war, and we had no desire to be made the subjects of rash experiments in economics, whether they took the form of deliberate inflation, protection, or capital levy. And from the fear of such experiments the election had delivered us, probably for a good many years to come. Government, it seemed, would in the near future be a matter not of rash legislation, but of administration carried on under constant and jealous observation, and subject to short shrift if it overstepped the limits of justice and sanity. That was not a prospect to inspire any serious alarm for the present. There was undoubtedly a feeling of uneasiness abroad—there had been a certain amount of selling of sterling investments in order to buy dollars. This had shown itself in the fall in the New York exchange; the fall which began with the talk about inflation had not been recovered as it should have been, and the £ sterling stood at a value in dollars which was considerably below its real purchasing power. In other words, the £ was depreciated not by any undue balance of trade, but for political and sentimental reasons. This ought not to be. Any pressure to sell British and buy American securities was not merely unpatriotic, but in his opinion very foolish. He had heard an expert opinion from America which asserted that it would be easy to lose in American investments quite as much as in any capital levy.

It might still be within their recollection that shortly before the war there was an active movement for investment in Continental securities, with the idea of evading income tax—dishonestly, of course. Those who adopted this course burnt their fingers badly, and deserved to do so; they might fairly be held up as a warning to those who were contemplating a similar course now. But however unpatriotic and unwise these weak-kneed folk might be, how infinitely more unpatriotic and unwise would it be to feed the anti-British Press in America with panic-mongering, and deliberately to damage the credit and reputation of the country in quarters where such attacks on Britain were cherished and magnified, and spread broadcast over the whole American continent. There was, as a matter of fact, no panic at present; there was a certain nervousness among the ranks of amateur investors; but it was the duty of those who were in a position of responsibility to look calmly at the facts, apart from any prejudices of personal or political disappointment and resentment. Such a dispassionate view, he was sure, led to no counsels of despair. It seemed to him that the convalescence of the country, after the fever of the war and the disastrous destruction which it involved, was proceeding with all the steadiness for which we could reasonably hope; "the patient is doing as well as can be expected," and the need of the day was, as before, for patience, work and peace.

The report was unanimously adopted.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

COLLINS (A. G.) AND BROTHERS, LTD., Cardiff, oil refiners. (M., 26/1/24.) Registered January 9, £1,000 debentures; general charge. *——. August 14, 1923.

TAYLOR'S DRUG CO., LTD., Leeds. (M., 26/1/24.) Registered January 10, £900 mortgage, to Mrs. G. Ashworth, 5, Greek Street, Leeds; charged on 11, Webster Buildings, Burnley Road, Padiham. *£104,858 13s. 10d. September 17, 1923.

THORNLEY AND KNIGHT, LTD., Birmingham, varnish makers. (M., 26/1/24.) Registered January 11, £3,000 debentures; general charge. *£3,000, November 14, 1923.

Satisfactions

INDUSTRIAL CHEMICAL CO., LTD., London, E.C. (M.S., 26/1/24.) Satisfactions registered January 10, £1,000, registered November 29, 1922; and £500, registered May 16, 1923.

THORNLEY AND KNIGHT, LTD., Birmingham, varnish makers. (M.S., 26/1/24.) Satisfaction registered January 11, £1,000, registered February 18, 1904.

Receiverships

BOOSHU MANUFACTURING CO., LTD. (R., 26/1/24.) W. B. Pearson, of 5, John Street, Bedford Row, W.C., was appointed receiver on December 15, under powers contained in debenture dated May 31, 1923.

NEWHAVEN SILICA CO., LTD. (R., 26/1/24.) A. B. Filson, of 2, Gresham Buildings, Basinghall Street, E.C., was appointed receiver and manager on December 8, 1923, under powers contained in debenture dated May 15, 1918.

London Gazette

Winding Up Petitions

RUBBER TAR, LTD. (W.U.P., 26/1/24.) A petition has been presented for the winding-up of the company by the Court. (Edinburgh Gazette.)

UNITED LABORATORIES AND CHEMICAL CO., LTD. (W.U.P., 26/1/24.) A petition for winding-up has been presented and is to be heard at the Royal Courts of Justice, Strand, London, on Tuesday, February 5.

Company Winding Up

CARLTON BLEACHING AND DYEING CO., LTD., Mar Hill Road, Station Road, Carlton, Nottingham. (C.W.U., 26/1/24.) First and final dividend of 3s. 8½d. per £, payable January 25, 18, Low Pavement, Nottingham.

Company Winding Up Voluntarily

MACEDONIAN OIL SYNDICATE, LTD. (C.W.U.V., 26/1/24.) H. R. Cooke, Esq., 23, Great Winchester Street, London, appointed liquidator. Meeting of creditors at Britannic House, Great Winchester Street, E.C.2, at 12 o'clock, on Thursday, January 31.

Notice of Intended Dividend

FULFORD, Arthur, trading as A. FULFORD AND CO., at 71, Bowdon Street, Sheffield, wholesale druggist. Last day for receiving proofs January 28. Trustee, C. Turner, 155, Norfolk Street, Sheffield.

Partnership Dissolved

SHARLAND AND CO. (Charles SHARLAND and Charles Norman Abbott SHARLAND), drug, chemical and sundry exporters, Eldon Street House, Finsbury, London, E.C.2, as from January 1, 1924, by effluxion of time. Debts received and paid by C. Sharland, who will continue the business.

New Companies Registered

ASHTON AND MOORE (METAL COLOURERS), LTD. To carry on the business of metal colouring by a process discovered or invented by L. C. R. Ashton and C. E. Moore. Nominal capital, £1,000 in £1 shares. Solicitors: W. L. W. Newey, 13, Temple Street, Birmingham.

BURY LIGHTING AND HEATING CO., LTD., 9, Elton Road, Bury. Metallurgists, chemical manufacturers, chemists, druggists, etc. Nominal capital, £1,000 in £1 shares.

COLLOISIL COLOUR CO., LTD., 116, Chestergate, Stockport, Cheshire. Colour manufacturers and merchants, chemists, drysalters, importers, exporters, and manufacturers of and dealers in colours, dyes, chemicals, etc. Nominal capital, £5,000 in £1 shares.

FAULCONBRIDGE AND HELEY, LTD., 48, Great Russell Street, London, W.C. Metallurgists, chemists, aniline and other dye and soap makers, etc. Nominal capital, £2,000 in £1 shares.

GALENA-SIGNAL OIL CO (OF IRELAND), LTD. Oil and colourmen, chemical manufacturers and dealers, etc. Nominal capital, £50,000 in £1 shares. A director: M. A. Wall, Hibernian Hotel, Dawson Street, Dublin.

JOHN B. INGE (SHEFFIELD), LTD., 321, Holme Lane, Hillsborough, Sheffield. Manufacturers and of dealers in soaps, olive oil, etc. Nominal capital, £2,000 in £1 shares.

MEDICAL PRACTITIONERS' UNITED DRUG CO., LTD., 41, North John Street, Liverpool. Pharmaceutical, manufacturing and general chemists and druggists, candle makers, manufacturers of perfumes, etc. Nominal capital, £100 in £1 shares.

MORGAN CHEMICAL CO., LTD., 6, Fenchurch Buildings, London, E.C. To acquire from A. Jaques, J. S. Morgan, S. R. Price, B. Stutfield, and Price, Stutfield and Co., Ltd., all processes and inventions devised, originated or owned by them at the date of the formation of the company, etc., and to carry on the business of manufacturers, importers, exporters and brokers of, agents for and dealers in all chemicals and chemical products, and all appliances and articles connected with the production, treatment and use thereof, etc. Nominal capital, £2,200 in £1 shares (2,000 7 per cent. cumulative preference and 200 ordinary).

FRANK SEGNER AND CO., LTD., Central Chambers, 40, Brazennose Street, Manchester. To deal in articles, merchandise and goods connected with the chemical or dyestuffs traders, etc.

J. SHARP AND CO., LTD., 2, Mount Street, Manchester. Dyers, manufacturers of and dealers in dyes, colours, chemical substances, industrial and other preparations. Nominal capital, £2,000 in £1 shares (1,000 7 per cent. cumulative preference and 1,000 ordinary).

SKUSE AND CO., LTD., 8, Lansdowne Mews, Lansdowne Road, Lambeth, London. Manufacturing chemists and druggists, etc. Nominal capital, £2,000 in £1 shares.

RHYS SPENCER AND CO., LTD., 32 and 34, Borough High Street, London, S.E.1. Drysalters, chemical merchants, dealers in drugs, pharmaceutical, chemical, industrial and other preparations. Nominal capital, £1,000 in £1 shares.

STANDARD SYNTHETICS, LTD., wholesale or retail manufacturers of synthetic chemicals, drugs, essential oils, etc. Nominal capital, £100 in 1s. shares. A director: K. S. Low, 34, Queen Street, Hammersmith, London, W.6.

G. STIBBE AND CO., LTD., 9–15, Newarke Street, Leicester, bleachers, dyers, makers of vitriol, bleaching and dyeing materials. Nominal capital, £350,000 in £1 shares (150,000 7½ per cent. "A" preference and 100,000 6½ per cent. "B" preference and 100,000 ordinary).

VENTURA, LTD., 215, Mare Street, Hackney, London, N.E. Soap boilers, manufacturers of and dealers in soap and all articles and substances used therein, and all waste and by-products and substances resulting from or in the course of the manufacture of soap. Nominal capital, £10,000 in £1 shares (3,000 8 per cent. cumulative preference and 7,000 ordinary).